ELECTRICAL REVIEW

and WESTERN ELECTRICIAN with which is consolidated ELECTROCRAFT

VOL. LXI, No. 8. CHICAGO, SATURDAY, AUGUST 24, 1912. ISSUED WEEKLY.

ELECTRICAL REVIEW WESTERN ELECTRICIAN ELECTROCRAFT

ELECTRICAL REVIEW PUBLISHING COMPANY
608 SOUTH DEARBORN STREET
CHICAGO

Charles W. Price, President and Treasurer.
A. A. Gray, General Manager. H. S. Tuthill, Secretary.
J. B. McCarthy, Asst. Gen. Mgr. C. W. Forbrich, Asst. Treas.

E. E. Wood . . . . . 13 Park Row, New York
Manager Eastern States.
J. B. McCarthy . . . . . Detroit, Mich.
Manager Middle States.
C. W. Forbrich . . . . . Chicago, Ill.
Manager Western States.
European Office . . . . . 42 Old Broad St., London, Eng.
Henry W. Hall, Manager.

ELECTRICAL REVIEW AND WESTERN ELECTRICIAN

Charles W. Price.....Editor-in-Chief
A. A. Gray.....Managing Editor
Morton Githens Lloyd.....Technical Editor
F. H. Bernhard.....Associate Editor
Howard Ehrlich.....Associate Editor
J. E. Latta.....Associate Editor

SUBSCRIPTIONS.

One Year, United States.....$3.00
One Year, Canada.....4.00
One Year, Foreign Countries.....6.00
Single Copy, 10 cents. Back numbers, beyond one month, each .25

Entered as second-class matter, November 7, 1908, at the Post Office at Chicago, Ill., under the Act of March 3, 1879.

CONTENTS.

EDITORIALS:
Improving Window Lighting in Small Towns.....337
"Electric" Shops.....338
College Textbooks and Technical Journals.....338
Seasonal Adjustment of Two-Rate Charge.....339
DEPARTMENTS:
Commercial Practice.....348
Electrical Construction.....350
National Electrical Inspectors' Association.....356
Among the Supply Men.....358
Public Service Commissions.....360
New Electrical and Mechanical Appliances.....370
Current Electrical News.....378
Record of Electrical Patents.....383
LEADING ARTICLES:
Electricity in Boiler Shops.....343
Electric Vehicles in Denver.—By J. A. McMeel.....348
Installing Conduit in a Small Building.....350
Elementary Notes on Alternating Currents.—IV.....353
Flashing Over in Commutator Machines: Its Cause and Prevention.—By W. W. Firth.....363
Electrical Installation at the Plant of the Acme Brewing Company.—By V. V. Newell.....364
The Place of the Small Motor in Manufacturing.—By George J. Kirchgasser.....367
BOOK REVIEWS.....362
MISCELLANEOUS:
Cooperation in the Electrical Industry to be Discussed at Conference.....340
Oklahoma Telephone Meeting.....340
Wireless Bill Passed.....340
Electrical Exports for June and for the Fiscal Year 1911-12.....340
H. B. Gear.....341
Railway Association to Meet in South Bend.....341
Program for Electrochemical Meeting.....342
American Institute Directors Hold Meeting.....342
Program of Edison Convention.....342
Long Service of Electric Trucks.....349
Economy in the Use of Wiring Material.....352
Among the Contractors.....352
Midsummer Meeting of the Electrical Supply Jobbers' Association.....358
Aluminum Production in France.....359
Quincy Installs Improved Lighting System.....361
Waste Steam Drives Motors and Saves Power Bill.....366
Some Experiences in the Tropics.....368

Copyright, 1912, by Electrical Review Publishing Company.

IMPROVING WINDOW LIGHTING IN SMALL TOWNS.

The opportunities at hand for the improvement of window lighting in small towns are still numerous, judging from a recent survey of a number of installations supplied with electricity from central-station circuits. There are, of course, many poorly arranged lighting displays in cities able to command the best illuminating-engineering advice, but nowhere is the value of correct equipment more apparent than in small places, because so much can be done at a moderate expenditure for lamps, shades and wiring. While it is true that the fundamentals of good lighting in connection with window displays are the same for large and small towns, it is noteworthy that improvements often can be effected in the latter with greater speed, less disturbance of business and at far less cost than in localities where severe inspection requirements and a high initial investment tend to hold back changes of a desirable character.

In the small town one often finds open wiring and the use of lamp-cord suspensions carried to great extremes, and in the worst installations the standard equipment is a 16-candlepower bare carbon lamp per window, the dusty bulb being hung at the level of the eye amid the goods displayed and producing a genuine feeling of repulsion instead of attracting the outsider to the wares shown. Such a violation of the principles of illumination is still common enough to justify its repeated condemnation, and every central-station manager should do his utmost to change installations of this sort, which reflect upon his company in the minds of close observers and actually make it harder for him to induce hesitating prospects to adopt electricity in place of other illuminating agents. The least that can be done is to supply the merchant with a cheap reflector and raise the lamp enough above the eye to avoid the direct glare of the filament. It is simply astounding how the use of a reflector will improve the lighting of the humblest little corner-grocery window, and one of the first lines of attack upon poor window illumination should be in the direction of discarding the use of bare lamps except in outline and sign lighting, which naturally fall outside of the scope of these criticisms.

Among the mistakes still common in window lighting are the following: using shades which are too small for the lamps in an effort to secure too

great economy in first cost; installing bare carbon lamps for general illumination within two or three yards of tungstens equipped with shades for directional lighting; failing to light all the units in a well designed display window and the complete shutdown of other equally good installations on several nights each week when the stores are closed; reduction of luminous flux by the placing of decorations and merchandise directly between the lamp and the area to be lighted; withdrawal of high-powered units and substitution of transparencies and "freak" designs in the central lighting scheme; neglect in cleaning shades and bulbs and the failure to install a complete layout after placing a part of the equipment in service. In the last instance a typical case was noted in a professional photographer's display window, which was lighted by a concealed fixture from one end only. Half the mounts shown were ineffective because the installation should have been planned with a lighting unit at each end.

Examples of these faults in window lighting are common to many small towns where too little attention has been paid to the best use of the available facilities, and they suggest to the central-station man a desirable line of approach in endeavoring to popularize good lighting in installations intrinsically simple in character.

"ELECTRIC" SHOPS.

It is rather surprising that industrial plants in which electricity is employed extensively do not in general make this fact more conspicuous in their advertising. Aside from all considerations of economy, and the like, there is a large class of industries in which the use of electricity insures a much higher quality of output than would be possible with any other form of power. In some cases, indeed, this superiority is so marked that there is general recognition of it on the part of the public. Even if the public does not know specifically that electricity is making possible a better grade of work in some particular industry, it does know in a general way of the splendid results which have been achieved wherever legitimate attempts have been made to apply this form of energy. In other words, there is already widespread recognition of the fact that electric service is synonymous with service of the highest order.

It is interesting in this connection to note the use which a rather humble, but very necessary class of craftsmen, in one of the large cities, makes of the fact just mentioned. In the city referred to there is a large number of small shoe shops in which electric motors are employed for driving sewing machines and other tools. The signs in front of these places nearly always announce that they are "electric shoe shops." This practice contains a suggestion which is unquestionably well worth consideration on the part of managers of other and larger industrial plants in which electric service has been adopted.

COLLEGE TEXTBOOKS AND TECHNICAL JOURNALS.

To the man of practice, probably the most striking paradox offered by our technical schools is the air of finality which still pervades so many of their textbooks. If these books were used in subjects in which progress had practically ceased long ago, as, for example, in the case of a Latin grammar, this trait would be quite excusable. Indeed, a Latin grammar may be fairly up to date even after several decades. But in technical lines every year means a decided progress in what has already been prominent, besides adding new developments and perhaps shifting the balance between different phases of each general line. To allow for this progress there must be an elasticity and an open-mindedness towards the unforeseen developments which may follow within a few years, or even a few months, after a book goes to press. Logically, this precludes the rounding up of each subject with the finality which would be perfectly proper in any non-progressive line. No one should be more conscious of this than the college professor or instructor, whose standing depends to a considerable extent on the degree to which he keeps in touch with the steady progress in his own line and in others allied to it.

And yet a glance at some of the textbooks used in the electrical-engineering courses of our leading colleges will show that too few such men have learned the art of allowing for further developments in books written by them. In other fields, where progress comes with slower strides and where a revised edition every two or three years may take care of the changes, such a position may be justified. But in the electrical subjects, where progress is not always reckoned by years, but often by months, this cannot hold. Indeed, it is difficult to understand such an attitude on the part of technical writers when we consider to what extent they must depend on the electrical journals and the published transactions of technical societies for keeping them abreast of the times. What is more, the timely articles with which every semi-annual volume of the electrical journals is crowded will supply a wealth of the more detailed information on various themes which the space limitations of a moderately priced textbook could not permit.

This last fact has evidently been appreciated by Prof. W. S. Franklin, of Lehigh University, whose new book, as pointed out by a reviewer in another column, includes nearly a hundred references to recent articles in the leading electrical and scientific periodicals. By this inclusion the far-sighted author is accomplishing three things: he is considerably enlarging the scope of his volume; he is acquainting his students with some of the publications to which they must look for much of their timely data and information; and he is impressing on them the fact that they must watch just such publications if they would keep pace with coming developments. To

find this feature in a volume which is at once lucid, accurate and generally up-to-date, is certainly refreshing; and if Professor Franklin's example would be more generally followed by writers of college textbooks, the coming years should show fewer graduates who are handicapped by not having learned that every vital textbook is subject to the weekly or monthly revisions and extensions contained in technical journals. Indeed, it is quite possible that the electrical-engineering textbooks of the future will be judged not only by the writer's presentation of his themes, but also to a large extent by the timeliness and authoritativeness of his references to periodical literature.

SEASONAL ADJUSTMENT OF TWO-RATE CHARGE.

General appreciation of the shortcomings and inequities of both the flat rate and straight meter rate as a basis of charges for electrical energy has led to the somewhat wide adoption of a two-rate charge, by means of which a higher figure is charged per kilowatt-hour for all consumption up to a certain amount and a lower charge per kilowatt-hour for all consumption of energy in excess of this amount. The consumption to be charged at the primary rate is usually fixed at so many hours' use of the maximum demand. The maximum demand is determined either through direct measurement by demand meter or by assuming an average value determined by the connected load, area or volume of rooms to be illuminated, or other simple means. This limit of consumption, for which the primary rate is charged, has usually a definite value for each month, and where current is used for lighting alone it may easily happen that the consumption will be less than this value during the summer months and greater during the winter months, so that at some periods of the year part of the consumption is charged at the secondary rate and at other parts none.

In England the dividing line between the two rates is sometimes placed upon a yearly basis, so that the primary rate might be charged, for instance, for all consumption up to 365 hours' use of the maximum demand and the yearly consumption in excess of this amount would be charged at the secondary rate. One objection to this method is the unequal distribution of the charge for the year, the bills naturally being heavier during the early months of the year and lower at the end of the year. In Glasgow, where the primary rate had been 12 cents per kilowatt-hour and the secondary rate two cents per kilowatt-hour for both business and domestic consumers, it was found that most domestic consumers used about the same amount of energy at the secondary rate as at the primary rate, and, in order to simplify matters, a single rate of seven cents per kilowatt-hour was adopted, which has since been reduced to six cents. This simplified the matter of billing and also made the rates more easily understood by the consumer, without materially affecting the receipts of the company. This applies to residence business.

In making a campaign for use of electrical energy for cooking and heating it became necessary to modify this rate in order to give the benefit of the secondary charge to consumers of more than 730 hours' use of the maximum demand, and it was arranged to apply the rate of two cents per kilowatt-hour to all consumption above this figure. In order to make it more fully apparent to the consumer that the extra energy used for these purposes was really charged at the lower rate, it was arranged to distribute the number of hours' use of the maximum demand to be charged at the primary rate through the different months of the year in proportion to the actual consumption for lighting purposes at the different seasons. Instead, consequently, of charging each month at the six-cent rate for the first 60 hours' use of the maximum demand, the year was divided into six periods of two months each and the hours' use of maximum demand for each of these periods was adjusted according to the requirements of the season. Thus, in December and January, the first 300 hours' use of the maximum demand was charged at six cents per kilowatt-hour; in October and November, 200 hours' use of the maximum demand was similarly charged; in February and March, 160 hours'; in August and September, 60 hours'; in April and May and in June and July, 40 hours.' This division corresponds to the number of hours of darkness between sundown and 10 p. m. at the various seasons. An examination of lighting customers' accounts showed the meter registration to give approximately the same result.

Such an adjustment of the hours' use of maximum demand to be charged at the primary rate provides that the expense for lighting shall remain at the previous figure and the additional cost for cooking or heating shall be based on the secondary rate, not only with reference to yearly consumption but also with respect to the monthly consumption. The customer thus finds that the additional cost of electric energy used for cooking and heating purposes produces the same increase in his monthly bill in the summer time as in the winter time. With the ordinary method of charging, the use of current for cooking in the summer, when its advantages are most apparent, is likely to appear in the bill as representing a large expense, since this extra consumption will probably not all be charged at the secondary rate.

Such a scheme might be applied with advantage in many communities in this country and would have its effect in furthering the use of electrical energy for cooking. The number of hours might well be fixed for each month, since in this country it is customary to bill monthly, instead of every two months, as in Glasgow.

Co-Operation in the Electrical Industry to be Discussed at Conference.

On September 2, 3, and 4 various representative committees from the National Electric Light Association, National Electrical Supply Jobbers' Association and the National Electrical Contractors' Association will meet at Association Island, Henderson Harbor, N. Y., to discuss plans for co-operation and mutual helpfulness in developing the electrical industry. The committees will be the guests of the Association Island Corporation. Beside the committees from the various associations, the meeting will also be attended by presidents of the National Electric Light Association, the American Institute of Electrical Engineers, the Association of Edison Illuminating Companies, National Electrical Contractors' Association, Illuminating Engineering Society, Electric Vehicle Association, and representatives of the larger electrical manufacturing companies and the technical press.

On September 3 a commercial program will be presented dealing in a broad way with the development of the electrical industry. A similar meeting was held last year at Association Island which proved very interesting and instructive, and a very successful meeting is expected this year. Philip S. Dodd, secretary of the Commercial Section of the National Electric Light Association, is chairman of the committee on arrangements.

Oklahoma Telephone Meeting.

At the semi-annual meeting of the Oklahoma Telephone Association, held at Oklahoma City, Okla., a report was received from the committee appointed at the last meeting of the Association to investigate the rate received for rural line switching. This committee sent out a blank report, to be tabulated, giving in detail the expense of furnishing rural line service.

In summing up this report, the committee found that the rate charged for rural line switching is altogether too low and that almost every company is losing money in furnishing this service. An effort is being made to establish a rate that will, at least, pay the expense of furnishing this service.

George Player, telephone expert for the Corporation Commission, in discussing that matter, stated that he felt sure the Commission would consider a rate that would be more just to the telephone companies.

The matter of commissions paid on long-distance business was brought up and most of the members seemed to be very well satisfied. E. E. Westervelt, general commercial superintendent of the Pioneer Telephone and Telegraph Company, expressed himself as believing that if the connecting companies would co-operate in keeping account of the overtime they could increase their commissions materially.

Addresses were also made by President R. S. Goffe, Secretary Horace Trureman, A. P. Watson of the Corporation Commission, C. P. Walker, L. T. Hines, W. J. Steele, C. E. Banner, R. P. Schultz and H. M. Tennyson.

Wireless Bill Passed.

On August 16 the new wireless bill was signed by President Taft, putting in operation in the United States the provisions of the international conference.

The bill requires all persons within the United States operating commercial radio stations in interstate commerce, or with foreign nations, or upon any American vessel engaged in interstate or foreign commerce, to take out federal licenses.

No radio station shall hereafter be licensed to be established within fifteen nautical miles of the naval or military wireless stations at Arlington, Va.; Key West, San Juan, San Diego, Cal.; North Head and Tatoosh Island, Wash., and those established in Alaska and the Canal Zone, but these government stations are to arrange for handling commercial radiograms under the provision of the Berlin Convention at rates subject to Congressional control. The bill provides an elaborate series of regulations and penalties for their violations by any wireless station.

No person engaged in or having knowledge of the operation of any radio station shall divulge the contents of any message transmitted or received by that station except to the persons to whom directed, or their authorized agent, or to another station employed to forward the message to its destination, unless legally required to do so by a court of competent jurisdiction or other competent authority. Persons guilty of divulging or publishing messages in violation of this prohibition are to be fined not more than $250, or imprisoned not more than three months.

Transmission Voltage to Exceed 150,000.

The Pacific Light & Power Company, of Los Angeles, Cal., is building a new hydroelectric plant on Big Creek about 60 miles east of Fresno. The power line from this station to Los Angeles will be 275 miles long and the line voltage will be between 150,000 and 175,000. Some Pacific Coast engineers assert that the climatic conditions in California are so favorable that 200,000 to 250,000 volts may be employed in future power-transmission projects.

Electrical Exports for June and for the Fiscal Year 1911-12.

The Bureau of Statistics of the Department of Commerce and Labor, Washington, D. C., has issued its monthly summary of the imports and exports of the United States for last June and, therefore, also its annual summary for the fiscal year ended June 30, 1912. From these statistics the following data on the exports of electrical products are obtained.

Due to the usual fluctuations from month to month, the figures for June show a falling off from those of the preceding month in both classes of electrical shipments, appliances (instruments and miscellaneous small apparatus) and machinery (heavy articles). This was not to be wondered at as regards the appliance exports, for those of May were extraordinarily large, breaking all previous records. The following table shows strikingly the monthly fluctuations in each class and in the totals during the past fiscal year and in June of a year ago:

Month	Electrical Appliances	Electrical Machinery	Total
June, 1911	$ 884,839	$825,091	$1,709,930
July, 1911	707,214	584,715	1,291,929
Aug., 1911	725,145	666,544	1,391,689
Sept., 1911	841,769	658,831	1,500,600
Oct., 1911	851,650	583,000	1,434,650
Nov., 1911	955,706	723,860	1,679,566
Dec., 1911	1,168,612	910,601	2,079,213
Jan., 1912	1,045,636	675,633	1,721,269
Feb., 1912	968,626	672,676	1,641,302
Mar., 1912	1,081,895	751,785	1,833,680
Apr., 1912	923,631	820,385	1,744,016
May, 1912	1,349,800	718,546	2,068,346
June, 1912	1,104,815	678,287	1,783,102

The following totals for the last six fiscal years, each including the twelve months ending June 30, show very conclusively the general trend of the electrical export trade. Among points of particular interest may be noted the marked slump of 1908 and 1909 and the excellent recovery therefrom in the more recent years, particularly in appliance exports, which have nearly doubled in the last three years and have since held the lead over the machinery shipments.

Year	Electrical Appliances	Electrical Machinery	Total
1906-07	$ 8,262,640	$9,005,766	$17,268,406
1907-08	6,754,217	8,495,219	15,249,436
1908-09	6,074,865	6,449,526	12,524,391
1909-10	8,694,132	6,048,263	14,742,395
1910-11	10,702,827	8,024,628	18,727,455
1911-12	11,724,499	8,444,863	20,169,362

Reverting back to the figures for last June, the principal countries to which electrical shipments were made and the values of these exports are given below:

Countries	Electrical Appliances	Electrical Machinery
United Kingdom	$ 38,202	$ 46,646
Canada	352,371	190,743
Mexico	103,121	90,370
Brazil	240,797	41,739
Japan	109,494	87,887

Extensive Electrification of Harbor Cranes at Hamburg.

The municipal authorities at Hamburg, Germany, have decided to change to electric operation within the next three years over 1,000 cranes that serve the extensive harbor of the city.

H. B. Gear.

Although one of the younger men in the field of electrical engineering, H. B. Gear is widely known for his accomplishments along electrical engineering lines and for his enthusiasm and ability as a student of technical problems.

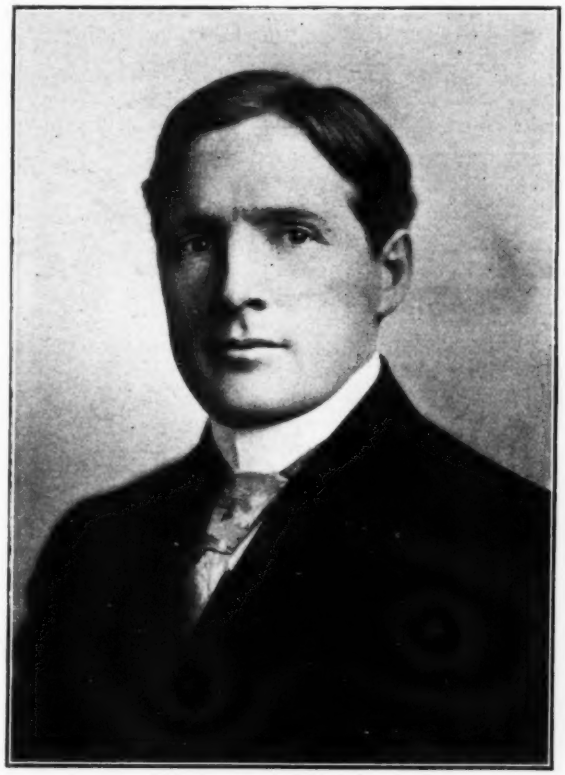
Mr. Gear is a Cornell man, having graduated from the electrical engineering course at Cornell University in 1895. Before entering Cornell, however, he had graduated from Marietta College, in Marietta, Ohio, the town where he was born. A few months after leaving Cornell Mr. Gear entered the service of the Commonwealth Edison Company, of Chicago, with which organization he has been associated continuously ever since. His first work with the Commonwealth Company was as an inspector of inside wiring. In 1897, in connection with the organization of this company, he was assigned the very formidable task of merging the distributing systems of the five electric lighting and power companies, which, prior to that time, had been operating in the southern part of the city, and while engaged in this work he made an extended study of the development of primary and secondary distribution, and worked out many of the details of the newly adopted four-wire, three-phase system of primary distribution.

In the year 1900 he was appointed to the position of general inspector in charge of the inspection of customers' wiring and the engineering of extensions to the alternating-current distributing system. The inspection department then had supervision of the regulation of the voltage of the system and the handling of the free renewals of incandescent lamps for customers.

Since March, 1911, Mr. Gear has been engineer of distribution for the Commonwealth Edison Company. This position involves the design of extensions to the transmission and distribution systems, both overhead and underground.

In connection with the growth of the alternating-current distributing system of the Chicago company, Mr. Gear has worked out many of the knotty problems which beset the path of the distribution engineer. Among the first of these was a solution of the problem of the most economical arrangement of transformers and secondary mains to produce the minimum annual cost. This was followed by a determination of the maximum demands of various classes of customers, which is necessary for an intelligent selection of transformer sizes and a minimum of line transformer investment. Perhaps the most important work was a series of observations which form the basis of a complete study of the diversity factor which exists between various classes of customers of electricity.

It should be mentioned here that on account of his researches in the subject of diversity factor the Western Society of Engineers awarded him the Chanute Medal a little more than a year ago now, this being an award established by the late Octave Chanute to encourage progress in engineering.



H. B. Gear,
Engineer of Distribution, Commonwealth Edison Company.

Mr. Gear has made an extended study of the protection of distributing lines from lightning and in conjunction with the operating department is still carrying on a series of experiments with a view to arriving at the most economical number of lightning arresters to be used for a given equipment of transformers and lines. He has presented papers before various engineering societies covering distribution subjects and has summarized the results of his experience in a book entitled "Electrical Central Station Distribution Systems," of which he is the author jointly with Paul F. Williams, assistant engineer of distribution of the Commonwealth Edison Company. This treatise deals with all phases of distribution engineering, such as the design of circuits, the regulation of pressure, connections, transformers for various special purposes, the economics of distribution, and the construction of overhead and underground lines.

Mr. Gear is a member of the Electric Club, the City Club and the Hamilton Club, of Chicago; an associate member of the American Institute of Electrical Engineers, a member of the Western Society of Engineers, and a member of the Illuminating Engineering Society. As the foregoing notes indicate, he is alert always to the necessities and opportunities of his profession. Moreover, he is a man of genial disposition, with whom it is a pleasure to be associated either in a professional or in a social way.

Railway Association to Meet in South Bend.

The regular meeting of the Central Electric Railway Association will be held at the Oliver Hotel, South Bend, Ind., on August 29 and 30. Sessions for the reading of papers and the transaction of business will be held on each morning, and in the afternoon trips will be taken to St. Joseph, Mich., Spring Brook Park and Gary.

Among the papers to be read at this meeting is one by E. S. Johnson entitled "Generating Apparatus for High-Voltage Direct-Current Railways."

Marconi Wireless School in New York.

The Marconi Wireless Telegraph Company of America has opened a school of instruction for wireless operators at 29 Cliff Street, New York City. Students are given a thorough course in commercial and technical wireless telegraphy. Technical classes will be formed at regular intervals, but applicants may enter the code classes at any time. Applicants with a knowledge of the Morse code are preferred. The graduates of the school will be particularly trained for service on board ship.

Program for Electrochemical Meeting.

As already announced, the fall meeting of the American Electrochemical Society will be held in connection with the International Congress of Applied Chemistry in New York City. Sessions will be held in conjunction with the sections of the congress on Electrochemistry and Mining and Metallurgy. Joint sessions will be held on Saturday morning, September 7, at Columbia University, on Saturday afternoon at the American Museum of Natural History, and on Monday and Tuesday at Columbia University. If necessary, additional sessions will be held for presenting papers by members of the Society. Among the many papers to be presented are the following: "Heat Losses in Furnaces," by F. A. J. FitzGerald; "Electrolytic Induction and Resistance Furnaces," by C. H. Von Bauer; "Recent Developments of the Electric Steel Furnace," by P. Heroult; "Electric Heating and the Removal of Phosphorus from Iron," by A. E. Greene; "The Function of Slag in Electric Steel Refining," by R. Amberg; "The Electric Smelting of Zinc Ore," by F. T. Snyder; "Cathode Impurities in Copper Refining and their Sources," by L. Addicks; "Oxidation of Atmospheric Nitrogen and Development of Resulting Industries in Norway," by Samuel Eyde; "Electrolytic Dissociation," by E. H. Loomis; "The Physical Nature of Biological Differences of Electric Potential," by R. Beutner; "The Relation Between the Potential of Liquid Amalgam Cells and the Constitution of the Amalgam," by J. H. Hildebrand; "Mineral Electrodes," by R. C. Wells; "The Silver Coulometer," by G. A. Hulett and G. D. Buckner; "Inclusions and Impurities in Electrolytic Silver," by J. S. Laird, G. D. Buckner and G. A. Hulett; "A Cadmium Coulometer and the Electrochemical Equivalent of Cadmium," by J. S. Laird and G. A. Hulett; "Coulometer Research," by G. B. Frankforter; "Study of the Magnetic Properties of Alloys of Boron with Iron, Cobalt, Nickel and Manganese," by B. du Jassonneix; "Recent Progress in the Electrolysis of Alkaline Salts," by E. Wilderman; "Mechanical Depolarization in Electrolytic Cells," by Alan A. Chaflin; "Power-Supply Characteristics of the Electric Furnace," by C. P. Steinmetz; "Study of a Small Carborundum Furnace," by W. D. Bancroft, L. V. Walker and C. F. Miller; "Determination of Oxygen in Iron and Steel by Reduction in an Electric Vacuum Furnace," by W. H. Walker and W. A. Patrick; "The Electrochemical Behavior of Very Concentrated Thallium Liquid Amalgams," by T. W. Richards and F. Daniels; "Electrolytic Nickel Solutions," by O. P. Watts; "Qualities of Carbon as Influencing Dry-Cell Construction," by Carl Hambuechen; "Electric-Furnace Alloy Steels," by J. A. Matthews and M. T. Lathrop; "The Electrical Resistivity of Fire Bricks at High Temperatures," by A. Stansfield; "The Electric Furnace for Heating Steel Forging," by Thaddeus F. Baily; "Electric Furnaces in Metallurgy of Steel," by A. E. Greene; "The Electrolytic Refining of Silver-Bismuth Alloys," by William N. Lacey.

Various excursions have been arranged by the different committees of the Congress. These will be open to only those members of the American Electrochemical Society who are also members of the International Congress.

American Institute Directors Hold Meeting.

The Board of Directors of the American Institute of Electrical Engineers held its regular monthly meeting on August 8 in New York City. President Ralph D. Mershon announced the appointment of the Institute committees for the ensuing year. The chairmen of these committees are as follows:

Executive, Ralph D. Mershon.
Finance, Charles W. Stone.
Library, Samuel Sheldon.
Meetings and Papers, Walter S. Rugg.
Editing, Lewis T. Robinson.
Board of Examiners, H. S. Putnam.
Sections, Paul M. Lincoln.
Standards, A. E. Kennelly.
Code, Farley Osgood.
Law, Charles A. Terry.
Railway, Frank J. Sprague.
Educational, H. H. Norris.
High-Tension Transmission, Percy H. Thomas.
Electric Lighting, W. C. Eglin.
Telegraphy and Telephony, S. G. McMeen.
Electrochemical, A. F. Ganz.
Power Station, H. G. Stott.
Electrophysics, John B. Whitehead.
Public Policy, Calvert Townley.
Historical Museum, T. C. Martin.
United States National Committee of the International Electrotechnical Commission, C. O. Mailloux.
Code of Principles of Professional Conduct, B. A. Behrend.
Indexing Transactions, G. I. Rhodes.
Relations of Consulting Engineers, Lewis B. Stillwell.
Patent, B. J. Arnold.
Sections Participation, E. A. Baldwin.
Revision of Constitution, C. W. Stone.
Membership, H. Clyde Snook.
Outgoing President's Testimonial, Walter S. Rugg.

The following members were appointed to represent the Institute:

Joint Committee of Engineering Education, Charles F. Scott and Samuel Sheldon.
Advisory Board of American Year-Book, Edward Caldwell.
Committee of the American Electric Railway Association on Joint Use of Poles, Farley Osgood, Percy H. Thomas and F. B. H. Paine.
Delegate to Sixth Congress of the International Association for Testing Materials, C. E. Skinner.
Joint Conference Committee of National Engineering Societies, Calvert Townley and W. W. Freeman.
Electrical Committee of the National Fire Protection Association, Farley Osgood.
On Council of American Association for the Advancement of Science, G. W. Pierce and W. S. Franklin.

At the previous meeting of the Board, on June 27, President-elect Mershon was made the first fellow of the Institute, and the following members were also transferred to the new grade of fellow: W. G. Carlton, Maurice Coster, A. F. Ganz, W. I. Schlichter, P. H. Thomas, Gano Dunn, Henry Floy, George Gibbs, Cary T. Hutchinson, William McClellan, H. S. Putnam, L. T. Robinson, G. F. Sever, F. J. Sprague and C. P. Steinmetz.

Program of Edison Convention.

The annual convention of the Association of Edison Illuminating Companies will be held at Hot Springs, Va., September 10 to 12. Reports will be presented by the various committees and in addition the following papers will be read: "Development of Meter-Testing Methods," by Frank V. Magalhaes; "Uses of Electricity for Purposes of Irrigation," by C. H. Williams; "The Relations Between the Public and Public-Utility Corporations," by H. M. Byllesby; "Rates," by Arthur Williams; "Present and Future of the Incandescent Lamp," by John W. Howell; "Welfare Department of the Edison Electric Illuminating Company of Boston," by Herbert W. Moses; "Improvement in the Design of Reactance Coils of Large Capacity," by P. Torchio; "Burning Oil Fuel as a Substitute for High-Tension Transmission," by F. H. Varney; "System Operator's Pilot Board and Substation Signaling System," by W. H. Lawrence; "Continuity of Service," by S. D. Sprong; "High-Tension Power Transmission in the West," by James H. Wise. There will also be an address by Charles P. Steinmetz.

In 1911 the United States excelled all other countries of the world in the conversion of raw asbestos into manufactured products, but a very small percentage was mined in this country, the larger part coming from Canada.

Electricity in Boiler Shops.

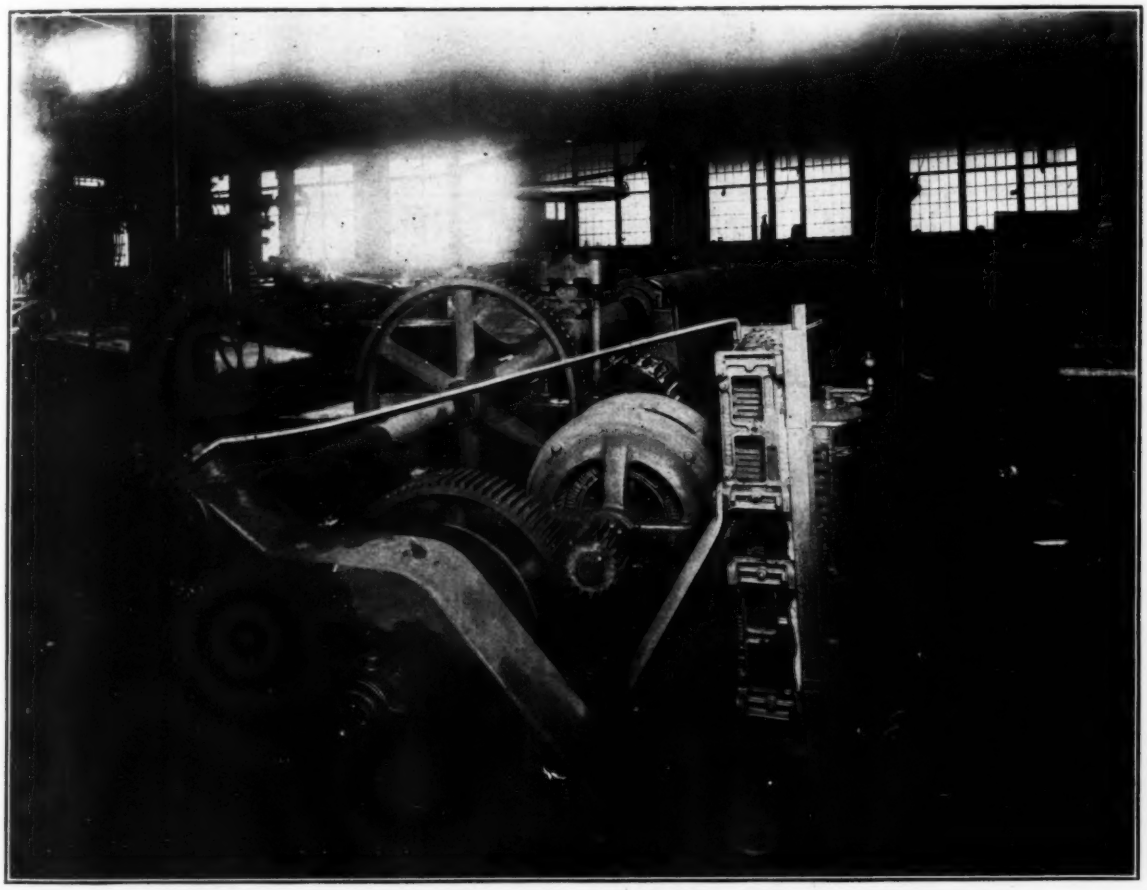
The satisfactory application of electric motors to heavy machine tools has lead to the almost universal adoption of this form of power in boiler works; while the severe operating conditions of boiler-making machines and the necessity for widely separated machines with abundant overhead space for cranes have made the individual motor drive absolutely essential. Under these conditions central-station power effects a considerable saving.

Nowhere have the advantages of electric motor drive been more prominent than in the boiler-making field. Here the compactness of the electric motor, its regularity of speed, its ease of adaptation to tools of widely varying size, its reliability under forced conditions of production and its flexibility of location have proved of great economic value. Incidental to the use of electricity are reduced belt and shafting troubles, decreased breakage of couplings and gears, possible increased output due to improvement in torque conditions and reduced labor cost in connection with the maintenance of equipment.

In the boiler shop the work carried on is of such a heavy character that only the best designs of equipment meet the requirements of continuous service. Rough and heavy raw material must be forced through the different departments of a boiler shop at maximum speed; the transportation facilities within the factory must be equal to the quick and accurate moving of all parts in both horizontal and vertical directions; the space inside the shop must be as free as possible from the encumbrances of line shafts and belts; and the tools must be located at the best points with regard to straightforward handling of the product from the laying-out division to the painting boy. For this kind of service electricity has demonstrated its superiority.

One of the interesting applications of electricity in the boiler shop is in the welding of shells, tanks and seams, especially in the manufacture of hot-water boilers and tanks for household and industrial service. Tests have shown that the electric-welded seam or joint is not only stronger on a bursting test than an oxy-acetylene brazed joint or a riveted seam, but also that the electrically welded seam resists the disintegrating effect of vibration better than other kinds. On strength tests the riveted seam invariably pulls apart at the rivet holes; the brazed joints are often found to be partially crystallized in the brazing, and are consequently weaker than the adjacent boiler shell. With the electric weld, however, the joint is not crystallized and is actually stronger than the adjacent shell, which parts under test at some other place than the welded seam.

The cost of electrically welding a longitudinal seam is about 13 per cent of the expense of a gas weld, and about



30-Horsepower Motor Geared to 12-Foot Bending Roll, Wildman Boiler Works, Chicago, Ill.

10 per cent of the cost of riveting or brazing.

Closely related to welding is the process of riveting. Hydraulic power has generally been used for this work, but on account of the high first cost of riveting equipment of this form, there has recently been a wider use of electricity made for this service. Combination hydraulic and electric machines, which combine the advantage of electricity with the effectiveness of water-driven equipment, are also now being extensively used. However, a vast majority of shops employ compressed-air machines for riveting and install a motor for operating the compressor. Compressed air is also extensively used for operating machine hoists, hammers, chisels, drills and forges. The figures in the accompanying table give some idea as to the horsepower required for various sized air compressors.

The data given below are for motor-driven reciprocating power compressors. These figures may vary somewhat, depending upon style and make.

Pounds Gauge Pressure	Horsepower of motor per 100 cubic feet of free air per minute.
25	7.5
30	8.5
40	10.4
45	11.42
50	12.12
60	13.60
70	14.56
80	15.25
90	17.
100	18.2

Ordinary air chisels require from 25 to 30 cubic feet of air per minute. Piston air drills require from 20 to 40 cubic feet of air per minute, depending upon the size.

Cutting, shearing, punching, drilling, bending, trimming, splitting and notching are the most common operations in the average boiler plant and the machines used may all be satisfactorily driven by individual motors. In fact, manufacturers of boiler-making machinery are now designing all equipment for direct, individual-motor drive.

A significant characteristic of boiler-shop practice is the distance ordinarily required between the successive tools on account of the length of the flues, plates, bars, etc., and the space required in laying out the work. The storage of material also requires considerable room near the laying-out division. The great weight of the materials handled, especially as the production process advances, necessitates ample clearance for powerful crane and hoisting facilities. The elimination of line shafting and belting becomes almost imperative under these conditions. The momentary overload capacity of the electric motor is a factor of great value in the boiler shop, especially in the operation of cutting and punching tools on stock of varying thickness and compressive strength.

7.5-Horsepower Motor Belted to Punch.

Five-Horsepower Motor Driving Splitting Shear.

7.5-Horsepower Motor Belted to Wicks Punch.

Selection of Motors.

Due to the fact that a large percentage of the machines in boiler shops operate at constant speed the alternating-current induction motor can be used to advantage. Owing to the wider range of speed control which is obtained in hoists and cranes driven by direct-current motors, this type has been very largely used, a motor-generator set supplying the necessary energy. However, in many of the later installations polyphase induction motors having a resistance connected in the rotor have been applied to this service with entire success, and simple and thoroughly reliable controllers can readily be provided to secure the variations in speed required.

The polyphase induction motor is built to withstand hard usage and to operate continuously under unfavorable conditions. The parts are few in number and the cost of maintenance and repairs is practically negligible. The electrical design is such that high efficiency is obtained over a wide load range, and the motor is capable of withstanding heavy overloads for considerable periods without serious overheating.

For operating shears, bending rolls, air compressors of large size and other machines requiring heaving starting torque slip-ring induction motors should be used. These machines combine heavy starting torque with low starting current. Other machines in a boiler shop are best operated by squirrel-cage motors, which can be connected to their load by belt, chain, gear or coupling. They start with full-load torque with from 2 to 3 times full-load current, and pull out or stop, if the maximum torque reaches from 2 to 4 times full-load torque. The slip, or speed drop from no load to full load, varies with the design and with the size of the motor, being less in large motors. Large slip is accompanied by high starting torque and is desirable for some applications, for example,

(Continued on page 347.)

Boiler Shops—Data Sheet No. 1

The term load-factor is used in these data in such a sense that a load-factor of 100 per cent represents the use for 24 hours every day of power corresponding to the rated capacity of the motors connected. An operating-time load-factor of 100 per cent represents the use of the rated capacity of the motors for the running hours per day specified for each installation.

Wildman Boiler Works, Chicago, Ill. This plant manufactures boilers of all sizes. Individual drive.

Total connected horsepower, 191.5. Number of motors, 15. Average kilowatt-hours per month, 9,525.

Kilowatt-hour consumption for 12 months: August, 7,600; September, 9,800; October, 9,200; November, 11,200; December, 9,700; January, 9,900; February, 8,800; March, 11,400; April, 10,200; May, 9,400; June, 7,200; July, 9,100.

Load-factor, 9.1 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts.

No.	Horse-power.	Speed R. P. M.	Application.
1	75	720	Slip-ring motor belted direct to a two-stage Chicago Pneumatic Tool Company air compressor, cylinders 10 by 12 inches and 16 by 12 inches; supplies air to riveters, chisels, air hoists, etc., at a pressure of 100 pounds.
1	15		Slip-ring motors operating a 7.5-ton crane, 35-foot span.
1	11		
1	3		
1	30	1125	Slip-ring motor geared to 12-foot bending rolls.
1	7.5	1200	Squirrel-cage motor belted to flywheel of Wicks Brothers punch, 48-inch throat.
1	7.5	1,200	Squirrel-cage motor geared to Kling Brothers No. 88 head punch.
1	7.5	1,200	Slip-ring motor geared to 5-foot bending rolls.
1	5	720	Squirrel-cage motor belted to flywheel of small punch, 18-inch throat.
1	5	1,200	Squirrel-cage motor belted to splitting shears, manufactured by the Columbus Machine Company.
1	5	1,200	Squirrel-cage motor belted to punch, 26-inch throat, manufactured by the Hilles & Jones Company.
1	5	1,800	Belted to a double emery wheel, 14 by 3-inch and 12 by 3-inch.
1	5	1,800	Squirrel-cage motor belted to 24-inch forge blower.
1	5	900	Belted to rumbler, 36-inch diameter by 20 feet long.
1	5	1,200	Belted to a Lennox bevel shear.

Energy is supplied by the Commonwealth Edison Company.

Boiler plant, located in Chicago, Ill., manufacturing boilers of all sizes. Combination drive. Running hours per week, 60. Total connected horsepower, 270.5. Number of motors, 16. Average kilowatt-hours per month, 18,375.

Kilowatt-hour consumption for 12 months: June, 15,540; July, 15,280; August, 16,520; September, 23,510; October, 16,500; November, 19,530; December, 16,020; January, 19,900; February, 19,790; March, 21,200; April, 21,520; May, 20,200.

Load-factor, 12.7 per cent; operating-time load-factor, 35.5 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts.

No.	Horse-power.	Speed R. P. M.	Type.	Application.
1	5	1120	Squirrel-cage	Belted to a 25-foot shaft (four hangers) driving one George Whiting Company No. 6 punch press, 5-foot throat, 43-by-6-inch flywheel; one 6-by-0.5-inch double emery wheel; one Springfield Machine Tool Company 16-inch milling machine; and one hack saw.
1	50	850	Slip-ring	Geared to Wicks Brothers 15-foot bending roll.
1	50	850	Squirrel-cage	Belted to 25-foot shaft (four hangers) driving one Gardner 12-by-8-inch air compressor, 150 revolutions per minute; one engine lathe with 7-foot face plate; one 16-inch lathe; one E. & A. Betts 24-inch lathe; one 24-inch planer; one Goulds No. 123 pump; one 12-inch drill; one Thomas Buckley & Company double shear, two 30-by-3-inch flywheels; one Cleveland punch, 48-by-4-inch flywheel; one Acme thread-cutting machine; one Cleveland 12-inch shear, 42-inch throat; one Kling Brothers 16-inch shear; one 8-by-2-inch double emery wheel; one Lennox bevel shear; one friction hoist; one Scully Steel & Iron Company horizontal punch; one 20-inch drill; one J. William 4-foot radial drill; one 18-inch forge blower; and one Buckley & Company No. 6 double punch.
1	30	850	Squirrel-cage	Geared to a Gould 3-by-8-inch triplex plunger pump.
1	5	1120	Squirrel-cage	Belted to a Buffalo No. 4 forge blower.
1	30	690	Slip-ring	Geared to a 9-foot bending roll.
2	5	1120	Squirrel-cage	Each geared to a Kling Brothers punch, 3-foot throat, flywheel 36 by 4 inches.
1	10	1140	Squirrel-cage	Belted to Lennox No. 3 bevel shear.
1	15	1120	Squirrel-cage	Geared to Kling Brothers punch, 5-foot throat, flywheel 48 by 8 inches.
1	22	680	Slip-ring	Operating the hoist of a Whiting 20-ton crane.
1	22	680	Slip-ring	Operating the bridge of above crane.
1	6	850	Slip-ring	Operating the trolley of above crane.
1	7.5	680	Slip-ring	Operating the hoist of a Whiting 10-ton crane.
1	5	850	Slip-ring	Operating the bridge of above crane.
1	3	850	Slip-ring	Operating the trolley of above crane.

Energy is supplied by the Commonwealth Edison Company.

Boiler Shops—Data Sheet No. 2

Joseph Bromich Boiler Works, Topeka, Kans. Boiler manufacturing and repairs. Combination drive. Running hours per week, 54.

Total connected horsepower, 157.5. Number of motors installed, 18. Average kilowatt-hours per month, 1,675. Kilowatt-hour consumption for 12 months: January, 840; February, 710; March, 430; April, 640; May, 2,410; June, 3,050; July, 2,220; August, 2,310; September, 1,120; October, 610; November, 2,700; December, 3,060.

Load-factor, 2 per cent; operating-time load-factor, 6.2 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is direct current.

No.	Horsepower.	Speed R. P. M.	Application.
1	3	1,120	Belted to blower.
1	8	1,120	Driving 6-inch angle-iron shear.
1	5	1,120	Driving small punch.
1	7.5	1,120	Geared to Hilles & Jones punch.
1	3	...	Geared to small bending roll.
1	5	...	Geared to small angle-iron roll.
1	10	...	Geared to bending roll 8-by-96-inch.
1	7.5	980	Belted to splitting shear.
1	7.5	1,120	Belted to Lennox bevel shear.
1	5	1,120	Driving hoist of riveting machine.
1	7.5	1,120	Belted to 8-inch pipe machine.
1	10	1,120	Belted to a line shaft driving two drills; two saws; one two-inch bolt machine; and one 15-inch lathe.
1	5	900	Belted to small re-punch.
1	1.5	1,200	Operating flue welder.
1	3	1,200	Belted to flue rattler.
1	16	...	Operating hoist.
1	8	...	Operating carriage of hoist.
1	35	900	Belted to air compressor.

Furnace and boiler plant making hot-air furnaces, steam and water boilers. The yearly output is 1,000 boilers. Total connected horsepower, 60. Total number of motors installed, 3. Average kilowatt-hours per month, 969.

Kilowatt-hour consumption for 12 months: January, 542; February, 654; March, 657; April, 1,392; May, 923; June, 908; July, 1,011; August, 947; September, 1,115; October, 1,080; November, 1,414; December, 992.

Load-factor, 3 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts and 500 volts, direct current.

No.	Horsepower.	Speed R. P. M.	Application.
1	5	1,700	Squirrel-cage motor belted to a 22-foot shaft and 4 countershafts driving one Needham Company nipple lathe; one double emery wheel; one O. L. Packard's 16-inch engine lathe; and one double emery wheel, 12 by 2 inches.
1	5	375 / 1,500	Shunt-wound motor belted to a Baker Brothers No. 12, 24-inch drill press.
1	50	850	Squirrel-cage motor belted to 60 feet of shafting driving one Bury 10-by-10-inch air compressor, 75 pounds pressure; one Root's No. 3 rotary blower; one 4-foot by 28-inch tumbler; one Climax wire straightener; one double emery wheel; one Barnes 24-inch drill; one Wood Light & Company 14-inch engine lathe; one 16-inch drill; one jig saw; and one 28-by-2.5-inch grindstone.

Boiler plant specializes in boilers for small industrial locomotives and engines. Combination drive.

Total connected horsepower, 121. Total number of motors installed, 20. Average kilowatt-hours per month, 7,345.

Kilowatt-hour consumption for 12 months: January, 3,980; February, 5,320; March, 6,470; April, 7,210; May, 7,570; June, 7,890; July, 8,080; August, 8,450; September, 7,380; October, 7,260; November, 8,460; December, 9,280.

Load-factor, 11.1 per cent.

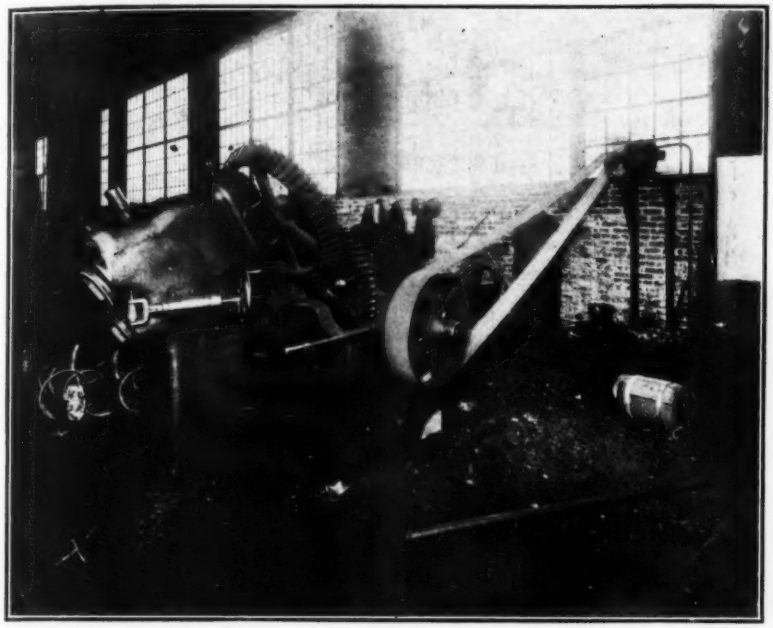
MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts and 110 volts, direct current.

No.	Horsepower.	Speed R. P. M.	Type.	Application.
1	10		Series	Operating respectively the hoist, bridge and trolley drives of a Whiting Foundry Company 5-ton crane.
1	5			
1	2.5			
2	5		Series	Each operating respectively the hoist, bridge and trolley drives of two Whiting 2-ton cranes.
2	5			
2	2			
2	7.5	1120	Squirrel-cage	Each geared to a Hilles & Jones No. 3 punch, flywheel 54-inch diameter.
1	12	Varying	Series	Geared to a bending roll, three rolls 8 inch by 96 in.
1	7.5	1120	Squirrel-cage	Geared to Wrangler bender.
1	7.5	1700	Squirrel-cage	Belted to 30-foot shaft driving one 16-inch drill; one 8-inch emery wheel; one pipe cutter; one 10-inch emery wheel.
1	5	1120	Squirrel-cage	Connected by chain to a Marshall & Haschart double bolt threader and cutter.
1	7.5	1120	Squirrel-cage	Geared to a Williams, White & Company No. 14½ double alligator shear.
1	2	1700	Squirrel-cage	Geared to a Bickford drill.
1	7.5	1200	Squirrel-cage	Geared to Hilles & Jones horizontal punch.
1	25	Varying	Series	Geared to a Bertsch & Company bending roll, three rolls each 12 by 144 inches.
1	10	840	Squirrel-cage	Belted to Sturtevant No. 9 blower.

where the torque fluctuates and a fly-wheel is used.

Shears are usually operated continuously, so the starting current required is not of particular importance. It



Five-Horsepower Motor Belted to Lennox Bevel Shear.

is desirable to have a motor of simple construction for continuous duty, and although some sacrifice is necessary, regarding starting conditions, an in-

7.5-Horsepower Motor Geared to Flange Punch.

duction motor with a cage secondary should generally be used for operating shears. The motor should be provided with high-resistance end-rings, as this form of construction gives very good starting conditions. As a maximum a 50-per-cent increase in torque with a 30-per-cent decrease in current and a 6-per-cent decrease in efficiency at full load may be obtained. A second advantage in using high-resistance rings is that the motor has a speed characteristic very similar to that of a direct-current compound-wound motor, thus allowing the fly-wheel to be effective during the cutting period.

The amount of resistance that can be included in the end-rings without undue heating is limited, as this heat energy must be dissipated in the motor. Where the motor operates continuously under virtually full load the maximum slip that can be obtained with high-resistance rings is approximately 10 per cent; but for intermittent service the slip can be increased to 15 per cent without undue heating. The efficiency and power curves of the motor will be similar to those of a standard direct-current shunt-wound motor having sufficient resistance in its armature circuit to give 15-per-cent drop in speed from light to full load; in other words, the slip of the motor varies according to the resistance in the end-rings. As the fly-wheel effect obtained from the system varies as the square of the speed at the high and low points during the cutting period, a slight increase in the resistance will produce a material reduction of the maximum load on the motor.

In shearing plates, the load is applied gradually and a motor with 15-per-cent slip will have a fairly smooth load curve, the fly-wheel being of liberal proportions. In the cases of hot bloom and scrap shears, where the section to be cut is quite large and practically square, the nature of the work becomes more severe. The actual cutting period is short and the power required large, which makes it necessary to include large fly-wheel capacity; and in order to prevent excessive loads motor should have a steep speed-curve. In the case of direct-current work it has been shown that increasing the compounding of the motor to 50 per cent has materially improved conditions. For induction motors, however, 15-per-cent slip is a practical limit, therefore to reduce the peak load for the heavier classes of machines fly-wheel capacity must be added.

In any class of machines where the load is intermittent, especially when cast-tooth gears are used in the reduction, the driving motor will be subject to considerable vibration. In many cases it is necessary to mount the motor on a frame or bracket support, although it is difficult to provide sufficient rigidity with this construction. This vibration causes undue wearing of the motor-bearings and tends to deteriorate the rotor-windings. The most effective way to prevent this vibration where gearing is to be used is to mount flexible coupling between the rotor and the driving pinion, which is keyed to a short length of shaft supported by two bearings. This form of construction has been adopted for a number of different drives where the work is very severe. It gives excellent results with little wear of the couplings and shows a decided decrease in motor maintenance.

The starting conditions are rather severe when the machine has large flywheel capacity and for shears as described above. The motor-starting apparatus should be of liberal capacity and should be provided with protective means to insure a gradual starting of the motor, thus preventing excessive starting currents. An autostarter is used for this work.

Use of Flywheels.

The addition of a flywheel on any machine having fluctuating power requirements, such as punches, presses, etc., steadies the load and makes possible the use of a smaller motor than would otherwise be possible. Owing to its inertia, a flywheel resists change of its condition of rest or motion. When in motion it possesses energy proportional to its weight, shape and the square of the speed. It absorbs energy when the speed is increasing and delivers it when the speed is decreasing. Hence, if the motor speed tends to decrease with increased load, the flywheel gives up energy and helps to carry the increased load, but absorbs the energy when the load decreases and allows the motor speed to increase.

For driving machines with large flywheel effect, or with flywheel attached, motors should have what is ordinarily called "poor speed regulation," that is, the speed drop with increased load should be enough to allow the flywheel to give up a liberal proportion of its stored energy. High torque is required for starting and accelerating flywheels to full speed, but as a rule, a motor designed with poor speed regulation to carry the load in connection with a flywheel, will be able to start it satisfactorily.

Horsepower Required.

The accompanying table gives a rather comprehensive list of horsepower requirements for the machines commonly found in boiler shops. The figures are, of course, for average conditions and although taken from tests and manufacturers' ratings should be considered only as approximate.

Figures of actual practice are given in the accompanying data sheet which contains detailed power information from three typical boiler plants.

Machine.			Horsepower required
P. G. No.	6	Ferrachute press	7.5
S. G.	86	Ferrachute press	5
C.	5	Ferrachute press direct geared	3
P.	21	Ferrachute press direct geared 18-inch throat	2
P. G.	56	Ferrachute press, drawing press	10
P.	3	Ferrachute press	3
P.	2	Ferrachute press, notching press	1
C.	92	Ferrachute press	1
E.	4	Ferrachute press, roll feed attachment	3
No.	18	Bliss flywheel press	0.5
No.	19	Bliss flywheel press	1
No.	20	Bliss flywheel press	1
No.	21	Bliss flywheel press	2
No.	52	Bliss flywheel press	2
No.	30	Bliss flywheel press geared	3
No.	36	Bliss flywheel press geared	5
No.	32	Bliss flywheel double-crank	3
No.	5	Bliss flywheel double-crank	7.5
No.	47½	Bliss flywheel double-crank	1
No.	74½	Bliss side cut-off side press geared	4
No.	1½	Bliss toggle drawing press	5
No.	3½	Bliss toggle drawing press	5
No.	68N	Bliss roll feed drawing press	2
No.	102	Bliss cut and carry gank press geared	3
No.	105	Bliss circular shear	0.5
No.	136	Bliss geared power shear	5
No.	105½	Bliss circular shear	0.5
No.	0	Bliss-Stiles flywheel punch press	0.5
No.	1	Bliss-Stiles flywheel punch press	0.5
No.	2	Bliss-Stiles flywheel punch press	1
No.	3	Bliss-Stiles flywheel punch press	2
No.	4	Bliss-Stiles flywheel punch press	3
No.	5	Bliss-Stiles flywheel punch press	4
No.	5	Bliss-Stiles geared press	5
No.	172	Bliss-Stiles sprue cutter flywheel	2
No.	173	Bliss-Stiles sprue cutter flywheel	2
No.	200	Bliss-Stiles automatic board lift drop	3
No.	400	Bliss-Stiles automatic board lift drop	4
No.	800	Bliss-Stiles automatic board lift drop	7.5
No.	2	Hillis-Jones combination punch and shear	5
No.	3	Hillis-Jones combination punch and shear with 36-inch throat punching 1.25-inch hole through one-inch cast iron	10
Steel punch, 0.25-inch hole in 0.5-inch steel			1
Steel punch, 0.625-inch hole in 0.5-inch steel			3
Steel punch, 0.75-inch hole in 0.25-inch steel			5
Steel punch, 1-inch hole in 1-inch steel			7.5

Commercial Practice
Management, Rates, New Business

ELECTRIC VEHICLES IN DENVER.

By J. A. McMeel.

The Denver Gas & Electric Light Company was one of the first central stations in the country to recognize the value of the business to be secured from the charging of electric vehicles. At the present day it is putting forth every effort to interest Denver merchants in the electric vehicle and the result of work is gradually beginning to show. The company maintains an electric-vehicle department under the supervision of a competent engineer and during recent months much general interest has been aroused in the electrically propelled machine. In addition to maintaining an electric-vehicle department, the company also publishes a small monthly magazine entitled *Electric Vehicle*, and this has been a wonderful help in the education of the Denver merchants.

Believing that the way to convince the public that the product you advocate is the best, is to use it yourself, the Denver Company has by degrees installed electric machines in all departments of its service, until today it has 20 machines doing its hauling and one pleasure car used by its electric-vehicle engineer. However, it was not the main idea of the company to merely advertise electrics by installing them in its own service. The whole matter was carefully gone into before electrics were purchased, and when the company realized that the electric type of machine would tend to increase the efficiency of its transportation system it made the venture, on a small scale at first.

About four years ago the company placed its first electric in service and this machine was used in the lamp department for the changing of incandescents. So well did the machine perform that it was decided to make other additions to its service. Later electrics were installed in the meter changing and setting departments and again they showed their superiority over horse equipment. At another time additional cars were purchased and placed in service in the line departments and for a third time the company was satisfied with the work performed by them.

Recently an order was placed for eight machines and these have been assigned to as many different departments. The company does not use any one make of machine and has several General Vehicle cars, Bakers, Waverleys, Detroits and a Fritchle—a Denver product—in its service. To accommodate the machines the company purchased some ground adjoining its west side electric station and built a garage on it. Here the cars are stored and charged and all repairing is done.

The service rendered by electrics in the moving and hauling of coke has been gratifying to the management. The cars proved beyond doubt that they are entirely dependable and their service during the recent severe winter was practically uninterrupted. In every other department they have been found to perform about 25 per cent more work than horse equipment, and in doing that cover a greater area in miles. The cost, however, is somewhat in excess of horses, but is warranted by the greater amount of work done. All things considered, the experience of the Denver Gas & Electric Light Company with commercial electrics has been very satisfactory. Of course, local conditions have a great deal to do with the efficient and economical operation of the trucks. Denver is comparatively level and when the weather conditions are taken into consideration it can be seen that a great deal of the success of this company with cars is due to these two elements.

Besides the local central station there are nine other business establishments in Denver using electric delivery service. In all there are 32 machines in actual daily service. Some of these have been used as long as three years, while others have been lately installed. Orders have been placed with some of the manufacturers for other machines by several non-users in this city, and when these arrive Denver will have a total of 35 machines working daily on the streets.

Most of the machines being used at the present time are for light delivery work and are owned by dry-goods establishments, bakers and music companies. One music company—the Knight Campbell Company—is now doing all its hauling with electric vehicles and has one General Vehicle machine and one Detroit in its service. All the other firms are operating electrics in conjunction with horse equipment. They assert, however, that as soon as they are able to dispense with horses without much loss they will do so. At any rate the way the machines are being operated affords an excellent advantage for the firms to compare the service rendered by horse equipment and electrics and in every case there is considerable saving in using the latter equipment. Besides, they give a greater mileage and are in service every working day throughout the year.

One firm, the Senter Pie Company, which has operated a Studebaker electric for the last three years, reports excellent service from the wagon. In the time it has been employed by the Pie Company it has not been out of service any length of time to speak of. This company has also secured excellent service from the batteries. Part of the original set is in the car today and there has only been about $120 spent in installing new plates in the battery. As far as repairs are concerned, none of the Denver firms have experienced much trouble from this source. The Macklem Baking Company, which used one Waverley of 1,000 pounds capacity and a 2,000-pound Studebaker, has only had a steering gear replaced on the Studebaker machine. This was not due to faulty or defective equipment but simply because the bakery management considered the steering gear originally used too light for its service. As the other machines are comparatively new, having been in service only about 18 months or less, it is pretty hard to tell just what will occur in the repairs line. Up to the present, however, there has been no need of extensive repairs of any kind.

One concern in Denver operates, in addition to a Detroit and Fritchle electric of 1,000 pounds capacity each, two gasoline machines. The manager of this firm recently told the writer that the cost of repairing the gasoline machines for one month was almost twice as much as it cost the firm for every item of upkeep expense on the electrics. The bills for repairing the gasoline machines for one month amounted to $150, while it cost only $90 a month for storage, current, washing, insurance and other items on the electrics. In view of this it is easy to realize why the electric is coming to the front as a hauling medium in Denver. During the next few months there should be a marked activity in the sale of electric vehicles of all types, as the merchants are beginning to realize more and more every day how really dependable the electric is. Several deals are pending now and will be closed as soon as a machine ordered by a local confectioner arrives and is put in service and demonstrates its worth.

As far as electric pleasure conveyances are concerned, Denver has always held to the fore in this department. It has more pleasure vehicles per capita than any other city in the country and every month this number is being added to. Recently 22 machines were sold in one month and since then the average has been about eight. The Denver Gas & Electric Light Company is now receiving quite a revenue from the charging of electrics, although it has not ventured into the charging field itself, being content to let the local garages and agencies have that field.

The Electric Vehicle, the magazine published by the company, wields quite an influence among the merchants and is creating quite a demand for the machines. The company also uses the newspapers to push the sale of electrics and in fact every available means, including bill-board advertising, is being utilized. With this force playing on the merchant so persistently it will not be long before the company will be able to reap a harvest for its efforts.

Long Service of Electric Trucks.

The durability and reliability of electric trucks is shown by several cases cited in a recent issue of *Modern Delivery*. Three electric trucks have been long and very successfully operated by Hammacher, Schlemmer & Company, a large hardware firm, of New York City. One of these trucks has been in service since the early part of 1903; another since December, 1904, and the third since June, 1907. In addition to the three three-ton trucks this company operates a 2,000-pound wagon bought in October, 1907, and a three-and-one-half-ton truck purchased in June, 1911. This splendid fleet of electrics has supplanted the company's entire equipment of horses and wagons.

The American Tool & Machine Company has operated one 2,000-pound electric wagon since January 30, 1906. On July 11, 1911, this vehicle went into the paint shop to be repainted, and up to that time had only been off the road for two days, this lay-up having been caused by an accident not in any way connected with the running of the vehicle. Two days off the road in six years—in which time all repairs of batteries, chains, gears and tires have been taken care of and painted up in first-class condition, making the vehicle appear as one just shipped from the factory—represents a record of performance that commends the electric on the points of durability and reliability. The cost of replacement, maintenance, etc., over this period of six years was exactly $1,509.00; the mileage during the period averaged 25 miles per day. On a basis of 300 actual working days per year, the cost of maintenance per day was 83.83 cents and on a basis of 25 miles per day, total cost of maintenance, etc., per mile is 3.35 cents. This is a figure to be proud of, but is only one of the numerous examples of what electric trucks are doing.

Electrical Construction

Installing Conduit in a Small Building.

Perhaps it should be explained that the following notes are not assumed to contain anything new to the electrician already familiar with the installation of conduit wiring in buildings of the type here considered. In very many of the smaller towns there is a great scarcity of electricians who have had any experience at all in conduit work, and this brief, elementary paper is written in the hope that it may contain something of interest and value to men of this class. The photographs used were

Fig. 1.—A Common Type of Switchbox.

taken in a small apartment house where the installation of the conduits had just been completed. The building is of brick, and there are three stories and a basement, the floor plan being that indicated in Fig. 7. The arrangement of circuits and outlets is practically the same on each floor. Rigid, unlined conduit is used throughout.

Fig. 2.—Ceiling Outlet Box.

In the district where this building is situated the circuits of the central station consist of overhead lines. The service to the building will be brought in through a line of conduit which extends uninterruptedly from the service switch in the basement, under the floor of the first-floor back porch and up one of the vertical posts which support the back porches to a point on the level of the second floor. It is the usual practice in the city where this installation is found to install the service cutout and switch in a metal cabinet, and to place this cabinet at the point where the service wires enter the building. This plan is followed in the installation under consideration. From the service cabinet the circuit is carried, in conduit, to the larger cutout cabinet

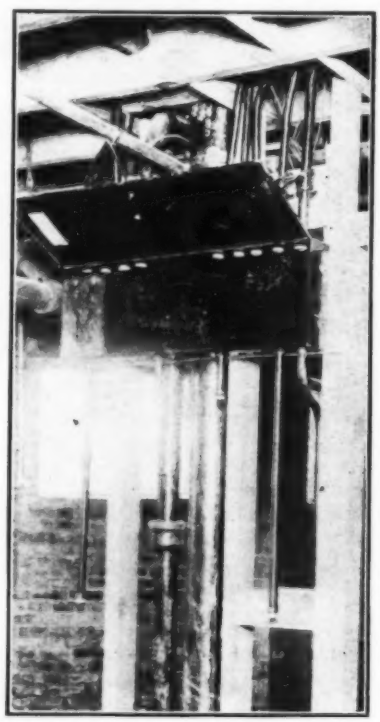


Fig. 3.—Cutout Cabinet Before Installation of Wires.

shown in Fig. 3, which serves as a sort of center of distribution of all the circuits in the building. The pipe which enters the cabinet from above near the right-hand end will contain the wires coming from the service switch. The meters will be installed on supports to be provided for them just below the cabinet, meter loops being run through the short pipes extending downward from the box. Eight lines of conduit extending upward will carry the circuits to the rooms above. Three of these lines will serve the first floor, three the second and two the third. Each tube will contain a 660-watt circuit.

A common method of installing the cutouts in a cabinet like that seen in Fig. 3 is to drill or punch holes in the back of the box, and fasten the cutout blocks with screws. The box itself is mounted on boards; a screw long enough to pass into these far enough for holding the cutout bases can easily be procured.

Brick buildings of the kind under consideration here are usually provided with double floors. What is known as the sub-floor consists of boards laid directly on the tops of the joists. This is covered with tough heavy paper or some other similar material. Strips of

Fig. 4.—Conduit Bushing and Locknut.

wood are then laid on the sub-floor, and on these the floor proper is placed.

Except in the case of the top story, the conduits which carry the circuits supplying ceiling outlets are laid on the sub-floor above the ceiling to be served by them, before the paper is put down. The tubes are fastened to this floor by means of pipe straps, which are metal cleats bent to fit snugly across the conduits and having holes in either end for nails or screws. In Fig. 8 parts of several runs of conduit may be seen, the sub-floor not having

Fig. 5.—Pipe Strap and Fixture Stud.

been covered up when this photograph was taken.

Each ceiling outlet is provided with a metal ceiling-outlet box of approved design, one of which is shown very clearly in position in Fig. 6. There are holes in the bottom of these boxes through which nails can be driven. The box is usually nailed to a joist or some other convenient timber. Outlet boxes, switch boxes, cutout cabinets, and the

like, designed for conduit wiring, are provided with what are commonly known as "knockouts." That is, when the box is made, the walls are cut in such a way that, at any time thereafter, circular metal disks may be readily punched out of them and openings for the ends of the conduit to enter the box thus provided.

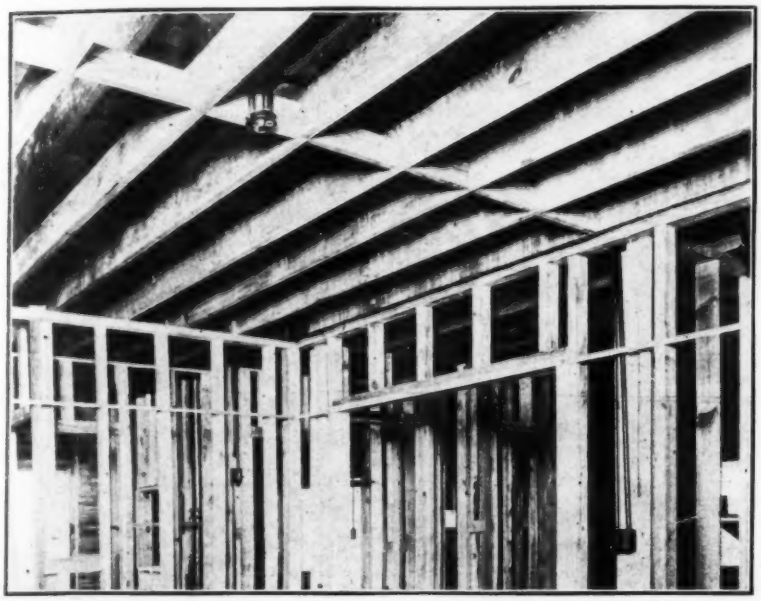


Fig. 6.—Showing Ceiling Outlet Box and Switchboxes in Position.

In the case of the ceiling-outlet box, in the class of wiring under consideration now, the conduit enters usually from above through knockout openings made for the purpose. Over the end of each tube a bushing is fitted which serves the double purpose of increasing the mechanical stability of the installation and of leaving no rough edges exposed, to injure the insulation of the wires while they are being pulled into the pipes. In Fig. 3, and also in Fig. 6, these bushings are clearly shown. Fig. 4 is a photograph of a standard type of bushing and the locknut which is fitted against the cabinet on the outside of it.

Fig 1 is a photograph of a switch and junction box used in the installation in question, and Fig. 5 shows one of the fixture studs. These studs are fastened in the outlet boxes by means of screws, and the fixture stem is attached to the threaded portion of the stem.

In this connection it is well to mention the desirability of running the conduit into a box normal to the surface of the box always, or as nearly so as is practicable. The writer has seen work in which, as a result of inaccurate measurement of length of conduit and improperly made bends, the pipes entered boxes at such angles that the locknut touched the surface of the box in but one point, and the fit of the bushing on the inside was equally poor. Another too common mistake is that of removing knockouts and then not using the openings thus made. Such a procedure largely destroys the value of the box as a protective device for the wiring on the inside of it.

Bending unlined conduits of such sizes as are used in small buildings is a comparatively simple matter. Care must be exercised, however, that the conduits are not flattened in the bending. A man who has some little skill as a mechanic can usually make good bends in a small pipe by means of a vise. Sometimes the wireman adopts the plan of making a bending device by rounding one end of a thick board and nailing this and another like it on top of a workbench in such a way as to leave a narrow trough between the adjacent parallel edges of the two. The pipe is laid in the trough and bent by being drawn around the curved end of the rounded board. A tool exceedingly convenient in bending conduits may be made by screwing a four-foot length of gas pipe into an ordinary gas-pipe tee. The conduit is slipped into the tee and the four-foot pipe used as a lever for making the bend.

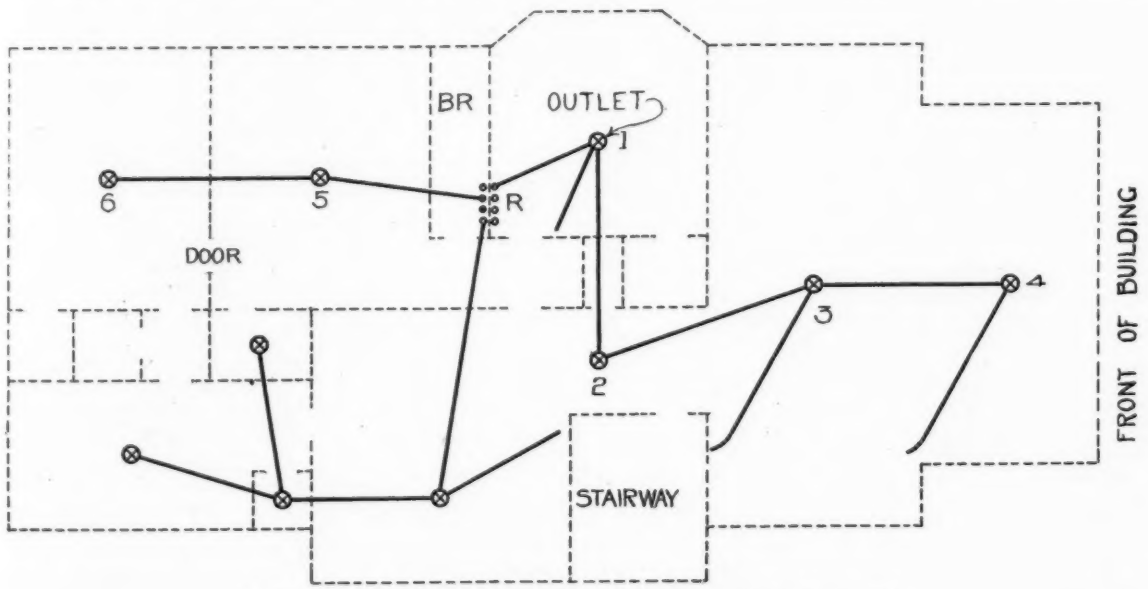


Fig. 7.—Positions of Conduit Risers and Circuits to Outlets on First Floor.

Rigid conduit is made in ten-foot

lengths, and ordinary couplings provided for fastening adjacent lengths together. Before the tubes are installed, the ends of each piece should be reamed out enough to make sure that no rough edges are left to injure the wire. Reamers made for this purpose can be bought from dealers in conduit-wiring supplies. In installing junction boxes, also, it is sometimes necessary to ream out one or more of the holes from which knockouts have been removed, in order to admit a larger pipe than that for which the knockout was designed.

It has been mentioned that Fig. 7 indicates the arrangement of ceiling outlets on the first floor of the building referred to in this paper. Conduit risers pass upward from the cutout cabinet in the basement, and at the point R three of these are bent horizontal and run along the sub-floor just above the ceiling of the first-floor room to the outlets in this ceiling. The conduit runs are indicated by the heavy, black lines in the figure. These outlets are thus supplied by means of three separate circuits from the cutout cabinet. One of these, for example, picks up outlets 1, 2, 3 and 4. The pipes having one end free from any outlet will either contain switch legs or circuits to wall brackets or baseboard receptacles.

The wires are pulled in where conduit work is installed after the plastering is done and the building otherwise practically finished. Double-braid rubber-covered wire is used, and for 660-watt circuits this is generally in the shape of what wiremen know as "duplex"—that is, two wires properly insulated one from the other but having a common fibrous coating around the two. Where the wires can not be pushed through from one outlet to another, they are fished through by means of a steel fish wire usually. If the conduit is correctly installed, the process of pulling in the wires is quite simple and easy.

Economy in Use of Wiring Material.

Where large shop areas are to be equipped with lighting systems, care should be exercised to secure economy in the use of all wires, molding, conduit, and the like, says a writer on industrial lighting in *The Electric Journal*. If the illumination design is turned over to the wiremen showing only the location of lamps, with no suggestion as to the lengths of conduit and the best fittings for each case, there is a tendency, after the materials have been placed on the floor, to misjudgment in connection with the cutting of wires or of conduit lengths. The design should, therefore, always be gone over carefully by the head wireman for the purpose of ascertaining the best method of procedure in the location of molding and switch circuits so as to reduce the actual material used to a minimum. This is, of course, a point of particular importance in those cases where iron conduit is used in large quantities and where accurate fittings are necessary in order to make the various lengths join up properly at the condulet openings. A prearranged plan of the conduit with accurate measurements on the drawing to indicate the various lengths and the best available fittings on the market for the various joints will, of course, tend to avoid waste.

A word may be said in passing as to the advantage of permanent as opposed to temporary wiring work. It is a temptation, especially in shops, to hang up the wires carelessly and in a temporary manner. Very often the wires will extend from one girder to another in such a way that a ladder employed for other work in the section is thrown against these wires, perhaps damaging if not altogether destroying the connections. Furthermore, the wires may be installed in such a confused manner that additions to the system are made very difficult through inability to locate supply circuits or connections that are desired. It is therefore exceedingly advisable to exercise a little additional care by installing the wires in a permanent and systematic form.

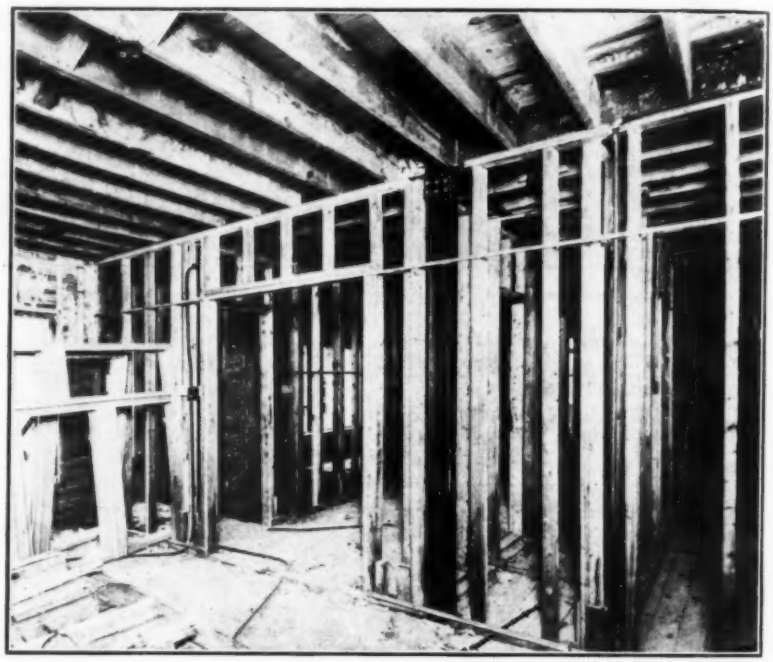


Fig. 8.—Method of Installing Conduit.

Among the Contractors.

The F. E. Newbury Electric Company, 431 South Dearborn Street, Chicago, has just secured contracts for installing the wiring for 1,600 incandescent lamps and 15 motors for T. J. McNulty; 7,000 lamps and 16 motors for the Marshall Field estate, and 5,000 incandescent lamps and 30 motors for Butler Brothers, all of these patrons being of Chicago.

R. W. Sanders, of Bismarck, N. D., has the contract for the wiring and fixtures for the new four-story addition to the Grand Pacific Hotel in that city.

A. S. Schulman, 417 South Dearborn Street, Chicago, has been awarded the contract to do the wiring for 2,000 incandescent lamps and a motor installation of 100 horsepower for Crane & Company, of Chicago.

H. J. Deggendorf, electrical contractor, of Milwaukee, has opened a store for the sale of electric supplies and electric contract work at 1734 Clay Street, in that city. He has equipped it with a full supply of electrical goods and will be able to care for the business that may come his way. A feature of the new establishment will be the fixture room. Here electrical fixtures are displayed in abundance, enabling the prospective purchaser to see the goods just as they will appear in his own home. Mr. Deggendorf is a capable, experienced electrician and should command a good patronage.

The electrical work in the Marshall High School building, which is being erected in Chicago, is being done by the Home Electric Company.

Elementary Notes on Alternating Currents.—IV.

From the standpoint of operation the induction motor is one of the simplest of electrical appliances. In order to insure the best service from this type of machine, however, it is necessary that an intelligent appreciation of the principles underlying the operation of the motor be exercised in the selection, installation and care of the unit. The following notes undertake to explain in an elementary way the more important characteristics of the induction motor.

As will appear during this discussion, the induction motor is in many ways similar to the ordinary stationary transformer. This probably explains the origin of the practice, which is now quite general, of calling that part of the machine to which alternating current is supplied from the source of power the *primary*, and of styling that member of which the other winding of the motor is a part the *secondary*. In modern practice the primary is usually the stationary part of the motor. Hence it is sometimes called the *stator*, while the secondary is referred to as the *rotor*.

The primary of an induction motor may be wound for single-phase, two-phase or for three-phase service, or, in other words, for single-phase or for polyphase service. Figs. 2 and 3 are photographs of the primary and the secondary, respectively, of a three-phase Westinghouse motor.

It can be shown mathematically that when a polyphase voltage is impressed on the primary of a motor wound for the same number of phases as the applied voltage, a rotating magnetic field is set up therein. This action may be thought of as a succession of alternate north and south magnetic poles sweeping along the inner surface of the primary structure of the motor. This progression of primary magnetism continues as long as the voltage is kept on the stator winding. Its direction of travel depends upon the order in which the phases of the primary current succeed each other; its speed depends upon the number of magnetic poles for which the primary is wound and upon the frequency of the primary voltage and current. The number of times per second that a given pole makes a complete rotation is found by dividing the frequency of the primary current by half the number of poles.

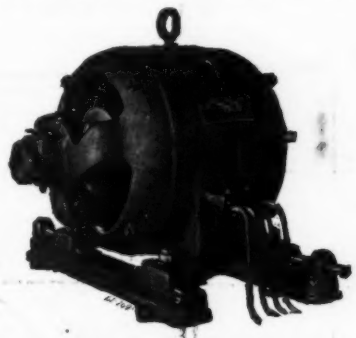


Fig. 1.—Single-Phase Commutator Motor.

The secondary of the polyphase induction motor is wound with conductors laid parallel with the motor shaft, these conductors being generally laid in slots or grooves in the iron core. In what is known as the cage type of rotor these conductors are short-circuited by being connected together at each end of the rotor by means of a conducting path of low resistance. Very often the rotor winding consists of copper bars connected at each end to a heavy metal ring, as in Fig. 3. It is this construction which led to motors having rotors of this type being classed as "cage-wound" machines.

A polyphase induction motor which must exert large torque, or turning effort, at starting is generally provided with a phase-wound rotor arranged so that extra resistance can be put into the rotor circuit at starting and removed when full speed has been attained. In such a case, the secondary is wound for the same number of phases as the primary, and a common method of providing the extra resistance needed during starting is to bring the secondary current out over slip rings on the rotor shaft to a resistance controller external to the motor itself.

It was explained in the first paper of this series that whenever a magnetic field is moved across conductors forming parts of a closed electric circuit an

Fig. 2.—Primary of Three-Phase Motor.

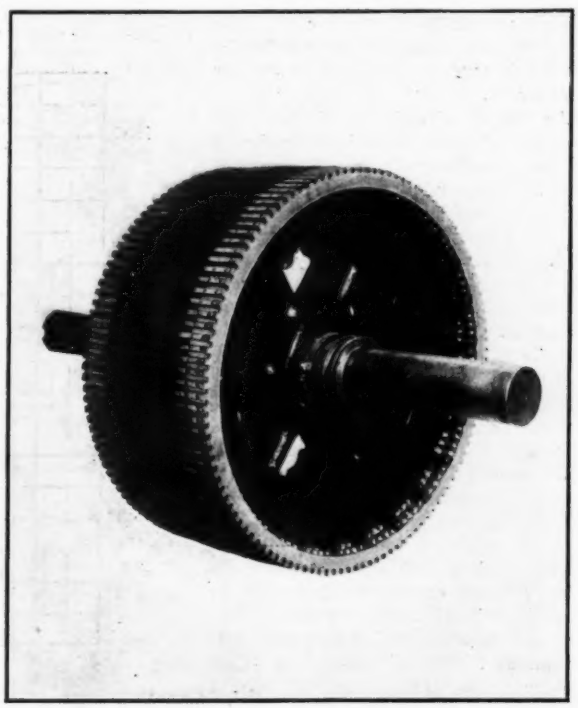


Fig. 3.—Secondary of Cage-Wound Motor.

electric current is established in those conductors. It is helpful to remember that in such a case the induced current has such a direction as to oppose the cause of induction. It is clear that if the secondary of an induction motor were rotated at the same speed as that of the rotating magnetic field of the primary circuit, and in the same direction, there would be no induction whatever in the secondary winding. In the actual operation of a motor of this type, the reaction between the secondary induced current and the magnetic field maintained by the primary current is such as to cause the rotor to revolve in the direction of rotation of this field. The difference between the rotor speed and that of the primary field varies with the load on the machine. If the speed of the rotor and that of the field were equal, the rotor would be said to have *synchronous* speed. The difference between its actual speed at any load and synchronous speed is the *slip* of the motor at that load. Slip is generally expressed as a percentage of synchronous speed. Thus if synchronous speed is 1,000 revolutions per minute, say, and the speed of the motor 950 revolutions per minute, the slip is 5 per cent. In a well designed motor running light the slip may be as low as 1 per cent, while in a poorly designed machine fully loaded it may be as great as 30 per cent or so.

As most electricians know, the strength of the current in the primary of an ordinary alternating-current transformer, under normal conditions of operation, depends upon the strength of the current in the secondary circuit. When the secondary is on open-circuit only sufficient current flows in the primary winding to magnetize the core of the transformer. If on the other hand, the secondary be short-circuited while the primary has the rated voltage applied to it, the primary current immediately becomes excessively great. While the rotor is stationary, a cage-wound induction motor is electrically very much like a transformer with its primary coils on short-circuit. It follows, then, that, while starting, such a motor may draw a very heavy current from the circuit supplying it with power unless means are provided for preventing this. The commonest way of prevention is to reduce the applied voltage at starting by the use of some type of auto-transformer or resistance. This, however, reduces the starting torque, or turning effect, on the rotor. In fact, the torque of the motor is proportional to the square of the applied voltage; so that a reduction of say 50 per cent in the applied voltage reduces the torque 75 per cent. These and other relations become rather clear from a close study of the following curves.

Data for the curves in the accompanying figures were supplied from the engineering departments of the General Electric Company and the Westinghouse Electric & Manufacturing Company. In Fig. 6 curves *1*, *2*, *3* and *4* indicate the relation of torque to speed with different voltages impressed on the primary of the motor, torque being plotted along the line *OY* and speed along *OX*. Curve *2* shows torque-speed relations for an impressed voltage lower than that applied to obtain curve *1*, while *3* and *4* are for voltages lower still. Consider curve *1*, for example. With the voltage for which this curve is plotted applied to the motor, the torque at zero speed, that is, the starting torque, is of a value represented by the length of line *OY*. At the speed represented by the line *OS* the torque is *SP*. When the primary voltage is lowered to the value for which curve *2* is drawn, the starting torque is reduced to the value *O H*.

Current, in amperes, is also plotted along the line *OX*, to a convenient scale. Curves *a*, *b* and *c* are the current curves, and each one of them is connected with its corresponding speed-torque curve by a dotted, vertical line. It is seen that for torque *O Y* the current is *O E*. If the load on the motor can be started by the application of torque *O H*, the starting current may be reduced to *O F* by reducing the voltage to curve *2*. If a starting torque greater than *O H* be required, however, the machine will not start at all unless a voltage greater than that for which

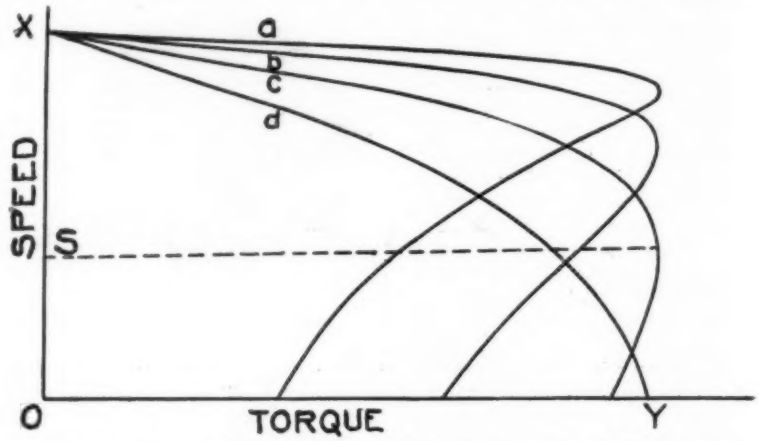


Fig. 4.—Curves Showing Relation of Torque to Speed for Different Amounts of Secondary Resistance.

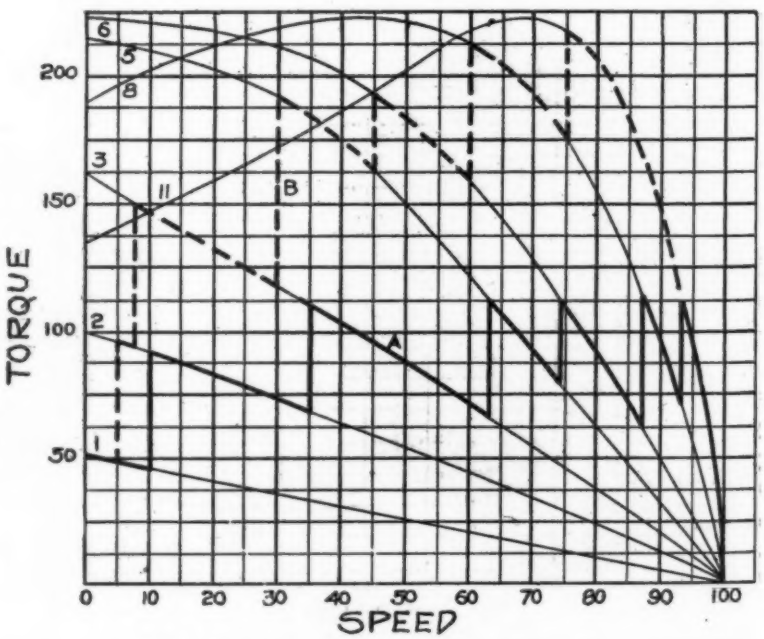


Fig. 5.—Speed-torque Curve for Standard Controller.

curve *c* was drawn be applied to it.

It should be explained that the curves of Fig. 6 were all drawn for constant resistance in the rotor of the machine in question. These curves are well worth careful study. They emphasize more clearly than is usual the necessity of making the proper choice of starting device for any cage-wound induction motor.

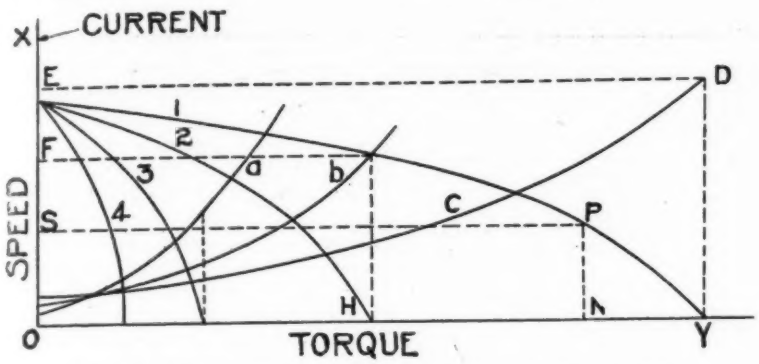


Fig. 6.—Relation of Torque and Primary Current to Primary Voltage.

In Fig. 4 curves are drawn to show the effect produced on the torque of a motor by varying the resistance in the rotor circuit. Curve *b* shows the relation of torque to speed for a secondary resistance greater than that for which curve *a* was drawn while curves *c* and *d* represent this relation for greater resistances still. It is seen that the maximum torque is the same for the four curves, this maximum torque being represented by the length of line *OY*. With resistance *d* in the rotor circuit, the greatest torque is obtained at starting, that is, when the rotor speed is zero; and when resistance *c* is employed the maximum torque is obtained when the speed of the motor is *O S*. In short, these curves show that increasing the resistance in the secondary circuit of an induction motor does not increase the turning effort which the machine can exert, but that it causes the greatest torque, or, for that matter, any given torque, to be exerted at a lower speed.

The fact just mentioned is frequently taken advantage of in engineering practice to secure speed adjustment when an adjustable-speed induction motor is wanted. In the secondary circuit of a machine having a phase-wound rotor a controller with adjustable resistance is inserted. For a given torque, the speed will be inversely proportional to the resistance of the secondary circuit. By increasing the resistance the speed is reduced, and vice versa. In Fig. 5 torque and speed are plotted in per cent of their normal values. The heavy irregular line starting at 50 per cent torque shows how these two quantities vary as successive steps of resistance are cut out in a certain type of General Electric controller. The heavy broken line shows the variations resulting from moving the controller handle at other speeds. Fig. 7 indicates the changes in the values of the primary current during this process.

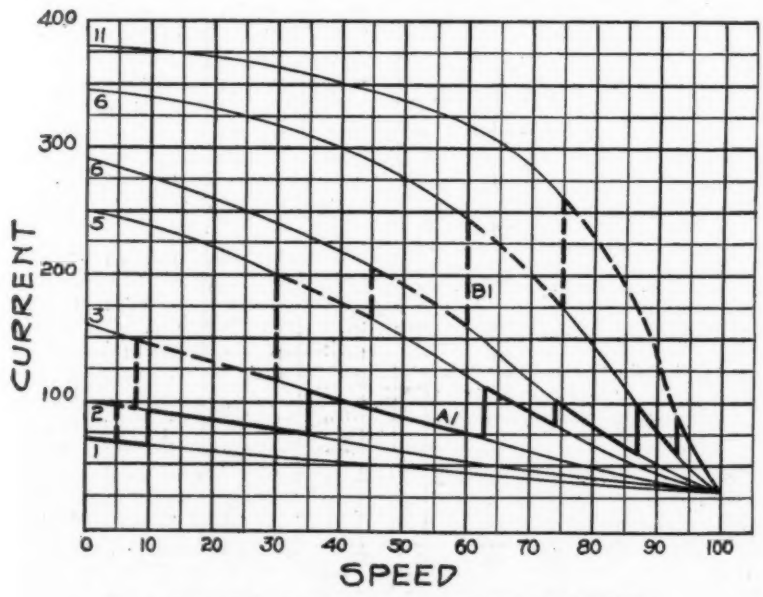


Fig. 7.—Speed-Current Curves for Standard Type of Controller.

It is to be noted in this connection that an undesirable effect of resistance in the secondary circuit of an induction motor is the resultant lowering of the efficiency of the machine. Hence where large starting torque is wanted but speed adjustment is not necessary after the motor is under way, it is customary to provide for cutting all the auxiliary starting resistance out of circuit as soon as normal speed is reached. In some types of machines the starting resistance is a part of the rotor structure itself, the arrangement being such that the resistance is short-circuited or shunted, either automatically or by the operator, at the proper time in the starting of the motor.

Before leaving the subject of induction motor characteristics it may be well to make some mention of the power-factor of this class of apparatus. While a cage-wound motor is running without load a very large component of the total primary current is a wattless magnetizing current lagging a quarter of a period behind the primary voltage. Hence the power-factor of the machine is low under this condition of operation. The magnetizing current being practically independent of the load, however, the ratio of the energy component of the primary current to the total current increases as the load on the motor is increased, and there is a consequent increase in the power-factor.

No such rotating field is obtained by impressing single-phase voltage on a single-phase primary, and hence the single-phase induction motor is not inherently a self-starting motor. When the rotor is once set turning, though, the reaction between the primary field and the secondary induced current will keep the machine running.

Several very effective and satisfactory methods are now employed for making single-phase motors self-starting. In one of the oldest of these, the primary has two windings, one of which is cut out of service after the motor is started. In circuit with this special winding for starting either extra resistance or impedance is connected. The resulting phase displacement of the current so modifies the motor field as to cause the machine to start. In some cases the rotor of the single-phase motor is provided with a commutator to make the machine self-starting. Fig. 1 is a photograph of a Wagner single-phase machine of the commutator type.

National Electrical Inspectors' Association

THOMAS HENRY DAY, President, 59 Deerfield St., Hartford, Conn.
JAMES BENNETT, Vice-President, 524 Coristine Bldg., Montreal, Que.
WILLIAM LINCOLN SMITH, Sec'y and Treas., Concord, Mass.
JAMES E. COLE, National Conference Representative, 11 Wareham St., Boston, Mass.

Executive Committee:

H. S. WYNKOOP, Chairman, 13-21 Park Row, New York

Frank R. Daniel, R. P. Strong, Henry E. Knight, Washington Devereux, James B. McCarthy, Wm. Lincoln Smith, James Bennett, C. W. Mitchell, George L. Collison, T. H. Fritts, James S. Meade, Thos. Henry Day, James E. Cole, Thos. D. McColl

Secretary's Message.

The Secretary has very little to say this month except to request those members who have not yet attended to the little matter of dues to please do so, as the money is needed. The receipts this year are, up to date, $47, out of a total due of $104. Please take notice and govern yourselves accordingly.

Neither has the Secretary received any large amount of response to his request for votes on the proposed change of name—only ten replies to date outside of the Executive Committee.

Perhaps summer and vacations with other similar matters have something to do with this, but it would appear to be sufficiently important to attract a goodly number of replies. *Let him have your ideas promptly!*

The matter appearing in this section consists of questions on the National Electrical Code, its interpretation and meaning, and questions as to whether certain methods of wiring are in accord therewith. These questions are gladly received from anyone interested, even if not a member; they should be sent to the secretary with any needed elucidating sketch. They are answered by each member of the Executive Committee according to his knowledge of what the ruling would be in his jurisdiction.

It should be understood that no pretense is made to give an authoritative interpretation of the Code. This is a voluntary association; it has representation on the Electrical Committee of the National Fire Protection Association, which prepares the Code, but it has no right, and claims no right, to give a final interpretation of anything in the Code. It is only intended to give the interpretation which seems correct to the members of the Executive Committee. No attempt is made to edit or correlate the answers from the different members of the Committee, as it is felt that the occasional difference of opinion is calculated to lead to a further study of the matter in question, further discussion and the final clearing up of obscure points.

The aim is to help toward a better understanding of the Code on the part of all; a more uniform conception of its meaning; increased precision in applying it; and harmonious action of those using it, for the common good.

Use of Knobs in Outside Wiring.

Question 194. Rule 12*d* forbids the use of porcelain knobs or cleats on the outside of buildings where exposed to the weather; but Rule 39*c* permits their use for outline lighting. Do not these rules conflict? Why, if knobs are allowed under 39*c*, may they not also be used where conditions are covered by 12*d*, if the run is a short one with no undue strain put on the knobs?

Answer 1. The use of knobs for outside wiring, under Rule 39*c*, is, I think, a makeshift arrangement intended to try out the results following the use of such construction. It must be remembered that the voltage contemplated by 39*c* is low, while that used under Rule 12*d* may be high, and it is necessary to have but one rule for all construction. In other words, Rule 12*d* refers more particularly to feeders, while 39*c* is intended for use on sub-circuits only.

Answer 2. Rule 12*d* is a general rule covering support of all conductors exposed to the weather and seems to contemplate more particularly service lines which are not directly protected by fuses. Outline lighting, also signs (Rule 83) are special conditions where all wires are properly protected by fuses and are supported at intervals very much less than is customary in general wiring. I consider Rules 39*c* and 83*c* as not in conflict with Rule 12*d* but rather as modifications thereof for specific cases.

Answer 3. It is difficult to see why Rule 39*c* should have been placed in the Code without at the same time modifying Rule 12*d*. It would seem also that "Outline Lighting" should be treated under Class B, "Outside Work," Rule 12, and not under Class C, "Inside Work", as it is evident that it is outdoor outlining that is meant. This latter point could be made clearer by a slight change in punctuation of the subheading under "Outline Lighting," Rule 39, thus: "Wiring (other than signs) on Exterior of Buildings."

Answer 4. See Class B, "Outside Work," and Rule 39*c*, "Outline Lighting." It is the intention of this ruling to cover the installation of wires which are installed on the outside of buildings, such as service wires and wires which run from building to building over roofs, etc., on structures, trestles, and on any exposed portions of buildings or under conditions where the wires and their supports are exposed to rain, sleet and snow. Frequently these wires are of large carrying capacity, and therefore protected by cutouts or circuit-breakers of large capacity, and considerable line loss or leakage would have to develop to open these safety devices.

As a general rule outline lighting is not directly exposed to the weather, being partly protected by portions of the building on which it is installed. The rule prohibits molding on account of the susceptibility of same for moisture. When outline wiring is installed on porcelain knobs, which the rule permits, the circuit never exceeds 1320 watts, so the liability of trouble is very remote. Also, it is a matter of judgment of the inspection department as to the amount of exposure the outline wiring would be subjected to.

Answer 5. Rule 12*d* was intended to apply only to the distributing wires of the public-service plant, including service wires up to the point of entrance to the building. None of the rules under Class B, "Outside Work," are intended to cover wiring which is under the protection of a service switch and cutout. The confusion in this instance is apparently due to the fact that the titles "Outside Work" and "Inside Work," preceding the rules of Class B and Class C, respectively, are not defined by the Code. This matter might very properly be the subject of amendments to be presented before the next meeting of the Electrical Committe.

Answer 6. My understanding of Rule 12, Sections *a* to *h*, is, that these sections apply to line or service wires which are not a part of the wiring of any one building, and are not protected by fuses within or upon the building as

would be the case in outline lighting under Rule 39.

Answer 7. Rule 12 covers all classes of outside wiring where there is no restriction upon the amount of current carried upon conductors and generally no fuse protection upon same excepting the primary fuse on transformers, where these are used. Under this condition the ground or short-circuit will be considered as serious. Rule 39*c* covers outline wiring where circuits are restricted to 1320 watts with ample fuse protection upon each circuit. In the event of a breakdown in the installation from moisture or atmospheric conditions, protection would be afforded by means of the fuse.

Answer 8. Rule 12*d* covers the construction between the pole and the main cutout. Rule 39*c* only takes care of the construction from that point on. The same conditions do not exist in each case.

Answer 9. Rule 12*d* forbids the use of porcelain knobs or cleats on the outside of a building where exposed to weather, and Rule 39*c* permits their use for outline lighting. It would seem as if these rules are inconsistent; but one is a separate and distinct type of installation which can be easily kept under control, whereas if the use of porcelain knobs is permitted under other conditions, present types of installation would be gradually superseded by the knob construction, which would be a much cheaper and a much poorer form of construction.

Answer 10. Rule 12*d* applies to service wires only.

Rule 39*c* applies to branch wiring, protected by an individual cutout and lighter fuses. Hence the hazard is not so great as in the case of service wires.

I can see no conflict between the two rules.

Answer 11. Apparently there is a conflict, but outline lighting is rather a special case and easily controlled and also is often somewhat sheltered by the design of the building.

I think it ought to be considered as an exception and so stated.

Proper Fuses for Switchboard Instruments.

Question 195. Rule 2*e*, covering fuse protection for instruments and pilot lights on switchboards, requires approved inclosed fuses, of not over two amperes if of other design than National Electrical Code Standard. Apparently six-ampere fuses, then, may be used if of Code design. Is this interpretation correct, or should all such fuses be limited to two amperes capacity?

Answer 1. Evidently this interpretation is correct. National Electrical Code standard inclosed fuses of six amperes capacity may be used; but other inclosed fuses should not be over two amperes capacity. However, I am at loss to understand the reason for the discrimination.

Answer 2. The interpretation of six amperes for Code fuses and two amperes for fuses of other approved types is correct. It seems evident that the framers of Rule 2*e* had a preference for Code fuses, but were at the same time willing to accept other fuses if of smaller capacity.

Answer 3. The interpretation stated is correct; standard Code fuses of six amperes may be used if the voltage does not exceed 110, or of three amperes if voltage is 220. Under the present wording of Rule 2*e*, an approved inclosed fuse of other than National Electrical Code standard inclosed type and of two amperes capacity may be used for either voltage.

Answer 4. The intention of the rule is to limit the capacity of the fuses other than those of the National Electrical Code standard on account of the liability of the small fuses (which are inserted in small glass tubes—see List of Approved Fittings) not being able to withstand the generation of gases in the event of a short-circuit or its equivalent.

These approved fuses are of special design for switchboards, pilot lights and instruments, and are at present manufactured by the Bryant Electric Company and the General Electric Company and are on the List of Approved Fittings.

Answer 5. The interpretation of the questioner seems to be correct.

Answer 6. I interpret Rule 2*e*, second paragraph, to mean that inclosed fuses or other devices that comply with the National Electrical Code standard for inclosed fuses may be used; but they are limited to two amperes capacity.

Answer 7. The wording of Rule 2*e* is such as not to conflict with the rule in the Code permitting the use of approved link-type fuses. With a two-ampere link fuse the amount of molten metal would be insignificant in the event of its blowing. This rule tends to urge the use of the approved type of plug or cartridge fuses for the protection outlined.

Answer 8. Either approved National Electrical Code inclosed fuses or approved inclosed fuses of other design should not exceed two amperes in capacity.

Answer 9. The interpretation is correct.

Answer 10. As I understand Rule 2*e* relative to the matter of fuse protection for instruments and pilot lights on a switchboard, it is considered preferable that the standard inclosed fuses be used, and there is a discrimination made in so far as the carrying capacity of the fuse is concerned in favor of such fuses. It is provided, however, that for the protection of instruments and pilot lights on a switchboard, approved inclosed fuses of other designs than the National Electrical Code standard inclosed fuses may be used, provided their capacity does not exceed two amperes.

Answer 11. Rule 2*e* specifically states two amperes as the maximum capacity of the fuses referred to. I can not see how the rule can be construed otherwise, and would so rule.

Increase in Platinum Production.

California and Oregon produced all the platinum which was mined in the United States in 1911, and this, as shown by the United States Geological Survey, was $8,631 greater in value than the output for 1910. It amounted to 628 ounces.

The average price paid for platinum in 1911 was $28.87 an ounce, compared with $24.38 in 1910, the higher price undoubtedly resulting in an increased production.

Importations in 1911 of crude platinum sands resulted in an estimated refined product of 27,500 ounces, nearly four times the domestic production. An additional amount was derived from imported ores and mattes, so that the total quantity of refined platinum produced in domestic refineries is estimated at approximately 29,140 fine ounces, of which about 940 ounces, valued at $40,890, was derived from domestic sources of various kinds—platinum sands, copper and gold bullion, etc. The corresponding estimate for 1910 was 773 ounces, valued at $25,277.

The platinum imported and entered for consumption in the United States in 1911, including ores and manufactured products, was valued at $4,866,207, an increase over the 1910 figures of $1,212,543. The exports amounted to only $8,139. The world's production of platinum in 1911 was 314,323 troy ounces, with 286,952 ounces in 1910.

Among the Supply Men

Midsummer Meeting of the Electrical Supply Jobbers' Association.

The midsummer meeting of the Electrical Supply Jobbers' Association was held at Niagara Falls, Canada, August 14, 15 and 16. Headquarters were established at the Hotel Clifton. The order of business followed general routine, and reports of committees were received and discussed.

One of the features of the meeting was the presentation of a brief address by P. S. Dodd, relating to a meeting of various committees nominated by the associations devoted to different activities in the electrical business, to be held at Association Island, Henderson Harbor, New York, September 2, 3 and 4. This matter was discussed at some length by the association, and it will be represented at this conference by W. W. Low, president of the Electric Appliance Company, Chicago; Frank S. Price, secretary of the Pettingell-Andrews Company, Boston; E. W. Rockafellow, general supply sales manager, Western Electric Company, New York; Roger Scudder, vice-president, Southern Wesco Supply Company, Birmingham, Ala.; W. E. Robertson, general manager, Robertson-Cataract Company, Buffalo.

The Supply Jobbers' Association will cooperate with the other associations in the matter of seeking some method for mutual assistance and helpfulness in developing the growing electrical industry. It will lend its financial assistance to this movement under the direction and upon the advice of its special committee.

The time and place of the next meeting will be decided in about a week or ten days.

The baseball game between the "Manufacturers" and "Supply Dealers" Thursday afternoon, was a hard fought battle and the result was in doubt until the eighth inning. At the beginning of this inning the score stood 6 to 4 in favor of the supply men, but there was a wonderful rally of the manufacturers at this time and runs to the number of 8 were made. At the end of the ninth inning the score stood 12 to 6 in favor of the manufacturers. Mine host, Thompson, of the Clifton Hotel, was the umpire, and the players were lined up as follows:

Manufacturers: Mac Guyer, Hight, Hunt, Klees, Dodd, Bibber, Mockenhaupt, Wildauer, Turner.

Supply Dealers: Terry, White, Oblinger, Hughes, Kinkhead, Hall, Worthington, Ludovici, Fullerton.

Chauncey Hight, who played shortstop for the manufacturers, dislocated his shoulder in sliding to second, and P. S. Klees received a severe bruise in the back of his hand from a hot pitched ball.

There was a large and appreciative audience, and the receipts from the grand stand seats on the grass and lawn rollers, and from the several cigar and peanut concessions (ably exploited by H. H. Cudmore, Oscar Turner, Charles M. Crofoot and others) were quite satisfactory and sufficient.

Thursday evening there was a concert at the hotel and electrical talent entertained the many listeners.

There were a number of dinner parties and automobile riding parties and the beautiful scenery on both sides of the Falls was greatly appreciated. One of the most enjoyable automobile trips was the Brilliant Cudmore tour, and embossed and illuminated resolutions were framed and given him by his guests, speaking eloquently of their gratitude and appreciation. Charles Martin Crofoot made the presentation address at the famous "Hospice" on the hill, his remarks being happily supplemented by Nelson C. Cotabish and W. N. Matthews.

J. Robert Crouse presided over a dinner party Thursday evening, which was well attended by "all together all the time" electrical men.

Two of the busiest men of the convention were those wideawake manufacturers Frank D. Sweeten, of Philadelphia, and Walter Jones, of Cleveland.

The work of the Jobbers' Association is intelligently managed by various energetic committees. The work done by E. W. Rockafellow, of the Western Electric Company, Charles E. Brown, of the Central Electric Company, Frank S. Price, of Pettingell-Andrews Company, all of whom were present, and others of the leading jobbing houses, is a monument of strength

Left Half—Group at Meeting of Electrical Supply Jobbers' Association.

to the enterprise, and far-seeing plans of the association. The organization seemed to be one big business family and there was a general atmosphere of fairness and harmony that it was gratifying to meet with.

There was a very representative attendance of manufacturers, among whom were H. B. Crouse, Syracuse; Waldo C. Bryant; Frank G. Burton, Bridgeport; A. D. Page, Newark, N. J.; P. S. Klees and E. R. Grier, Hartford; H. H. Cudmore, N. C. Cotabish, J. Robert Crouse, Cleveland; Frank Brookfield, A. Hall Berry, Charles Schoenfeld, F. E. Watts, E. B. Kittle, J. B. Underhill, New York; C. E. Corrigan, H. B. Kirkland, Samuel A. Chase, D. H. Murphy, Pittsburgh; H. C. Adams, W. F. Field, Pawtucket; Robert E. Gorton, Warren, O.; Warren Ripple, South Bend; H. T. Paiste, Philadelphia; W. J. Meyers, Springfield, Ohio; C. L. Hight, A. P. Eckert, G. M. Jost, New York; W. M. Deming, H. W. Kilkenny, Schenectady.

Although a midsummer meeting, with nothing but executive and formal discussion on the program, the attendance was very large. Among the many supply men and manufacturers present, in addition to those already mentioned were the following:

H. E. Leonard, Schenectady; J. Frank Newcomb, Walter Webbing, G. W. Stuart, F. D. Masterson, Albert Mann, Boston; R. E. Campbell, H. Hutchinson, H. S. Greene, H. C Rice, L. Griesser, Cleveland; I. S. McLean, George L. Gillon, F. W. Eastman, P. M. Fletcher, A. P. Eckert, T. H. Bibber, E. D. Kiefer, P. S. Dodd, Chas W. Price, P. H. Hoover, M. A. Oberlander, Frank Brookfield, G. W. Elliott, W. B. Kinkhead, G. L. Hathaway, Thomas M. Debevoise, B. G. Kodjbanoff, C. C. Sibley, P. B. Cressman, H. W. Bliven, T. M. Hawkins, New York; Robert Kuhn, Henry L. Walker, W. J. Hartwig, W. H. Seldon, O. D. Steffey, Jas. B. McCarthy, Detroit; W. T. Thomas, W. Gloeckner, E. H. Peterson, Oscar Carman, P. Worth, J. W. Becker, Cincinnati; J. R. Worth, H. P. Andrae, Milwaukee; A. E. Williams, J. B. Estabrook, Warren; W. L. Adams, L. M. Lavine, Providence; Julian Binford, Jr., Richmond; W. S. Bissell, G. B. McNary, Toledo; W. A. McCombs, J. P. Provost, W. J. Bickford, A. E. Beling, E. H. Sutton, W. I. Patterson, Pittsburgh; J. E. Greene, C. M. Little, Syracuse; W. J. Dougherty, Montreal; G. C. Knott, E. S. Mack, Toronto; W. N. Matthews, St. Louis; Otis C. White, W. R. Bliss, Jr., Worcester, C. J. Litscher, Grand Rapids; Morton Haven, Jr., C. Russell, Albany; McKew Parr, Hartford; W. E. Robertson, Buffalo; W. W. Mumma, Springfield; Frank Stout, Bridgeport; G. W. Johnson, Omaha; M. B. Austin, P. F. Lyons, R. D. Gloeckner, F. T. Benson, H. E. Watson, G. S. Searing, Chas. A. Harding, George C. Richards, C. R. Hunt, W. H. Coleman, L. W. Kittman, H. L. Grant, James Wolff, James H. McGill, A. S. Merrill, V. R. Despard, F. R. Bryant, L. G. Mockenhaupt, A. B. Hatch, W. W. Low, Franklyn Overbagh, E. K. Patton, Chicago; F. X. Cleary, T. N. Lockwood, New York; E. J. Kulas, Cleveland.

A fine group photograph was made in front of the Clifton Hotel, and a reproduction is printed herewith. This photograph illustrates the great versatility of the well known electrical man, a striking example being the prominent position occupied by Nelson C. Cotabish, sales manager of the National Carbon Company, at both ends of the picture.

Group at Meeting of Electrical Supply Jobbers' Association.—Right Half.

Aluminium Production in France.

It is stated in a British consular report from Lyons that large works for the manufacture of aluminium by the Serpeck process are about to be established by L'Aluminium Français, a combination of the French manufacturers who have acquired the world rights of the process. Hitherto these rights were vested in the Société des Nitrures, who obtained them from the Swiss holders of the patent, and erected experimental works near St. Jean de Maurienne. The new works are to utilize 40,000 h. p., and it is hoped to manufacture the metal on a large scale and to extend its use by all possible means. The combination contemplate the erection of rolling plant near Chambéry, and it is hoped that, with sufficient water power, very large reductions will be effected in the cost of manufacture. It is stated that the rights for the United States have been conceded to a subsidiary company, and that licenses will be granted for other countries.—*The Times* (London).

A Telephone Time-Saver.

According to the London *Times*, a device called a "Telephone Time-Saver," invented by H. Waymouth Prance, of London, consists of a sound-magnifying trumpet, of flattened form similar to certain types of motor horns, behind which is a platform adapted to support the telephone receiver. On receiving or making a call and being asked to "hold the line a moment," the user, instead of "holding on" with the receiver pressed to his ear, merely drops it upon the platform of the device, where it automatically slides into position with the earpiece against the small end of the trumpet. The user is then free to go on with his work until the voice from the trumpet shows him that the person at the other end is speaking, when conversation may be carried on by means of the loud speaking trumpet, or the receiver may be lifted off the instrument and used in the ordinary way. The devise has met with some popularity.

Public Service Commissions

MASSACHUSETTS.

The Massachusetts Gas and Electric Light Commission has approved the consolidation of the Hyde Park Electric Light Company with the Edison Electric Illuminating Company of Boston. The Hyde Park Company supplies electricity in that suburb of Boston known as Hyde Park. Its stock has hitherto been held by interests affiliated with the Bay State Street Railway and much of its business has been the generation and sale of electricity for street-railway purposes. At the time of the purchase by the Edison Company the Hyde Park Company had outstanding capital stock of $287,500 and a large floating debt. Its stock was purchased at par. Soon after the company sold its generating plant, except certain electric lighting dynamos and engines, to the Bay State Street Railway Company for $285,000. This enabled the company to pay its ordinary notes to the amount of $168,000 and to pay its stockholders a dividend of 40 per cent, or $115,000, in partial liquidation. On April 1, 1912, it had outstanding coupon notes for $28,000 and other debts of $8,928. The book value of the plant, after deducting the power plant sold, was $254,393. The terms of the sale are that the Edison Company pays $187,000 in cash and assumes the $28,000 coupon notes and the cost of addition to plant since April 1.

The Board says that the close association of the Hyde Park Company with street-railway interests has never brought any advantage to other customers either in rate or service. The present maximum net rate is 13.5 cents per kilowatt-hour and as soon as the sale is completed the rate will be 10 cents maximum. The recent union of Hyde Park with Boston makes the merger of the companies of advantage to the community.

The Commission has also approved the purchase by the Edison Electric Illuminating Company of Boston of the Weston Electric Light Company's franchise and property. The Weston company has lines, and supplies electricity in Weston, Sudbury and Wayland, Mass. The Edison Company has lines in Wayland, and in several towns and cities contiguous to Weston. At the time of purchase the Weston company had outstanding capital stock of $30,000 and notes of $26,200. Its plant and other assets amounted to $91,000. The stock of the Weston Company was purchased for $300 per share, or $90,000 in all. By the terms of the purchase the Weston Company conveys all its property to the Edison Company for $112,000 in cash and the assumption of cost of additions to plant since April 1. Prior to this year the Weston Company has owned its generating station. The maximum net price for commercial lighting has been 15 cents per kilowatt-hour, and its charge for 50-watt tungsten street lamps, burning about 1,600 hours per year, has been $12.50 per lamp. The purchase will give the public the Edison regular rate of 10 cents per kilowatt-hour for maximum, while the rate for street lamps amounts to $14.80 per lamp per year. Counsel for the town of Weston protested against the purchase provided the result is to increase the cost of street lights. The Board states that it does not follow that the Edison Company will be justified in increasing the price of street lights, which for a considerable time the Weston Company has found adequate. The Board states that the increased ability of a large company serving a great population over a small company with restricted territory is so manifest as ordinarily to warrant approving a merger of this sort, and believes this in the public interest.

The Marion Gas Company, of Marion, Mass., has been granted authority by the Massachusetts Gas and Electric Light Commission to furnish electricity in the town of Bourne north of the Cape Cod Canal, and the Buzzards Bay Electric Company has been authorized to carry on the business of electric lighting and heat and power south of the Canal. This action is taken by the Board in an attempt to make a fair division of the territory.

The Board has approved the issue by the Worcester Suburban Electric Company, of Worcester, Mass., of 2,000 shares of new capital stock, the proceeds to cancel promissory notes and to pay for additions to plant.

The Amesbury (Mass.) Electric Light Company has been authorized by the Board to issue additional capital stock of the par value of $14,700 for the purpose of increasing its generating plant and extending its lines.

MICHIGAN.

The State Railroad Commission has approved the petition of the Bell Telephone Company and the Home Telephone Company, the independent company of Detroit, for permission to consummate a deal whereby the Bell Company will absorb the independent line. The Commission states, in its written opinion, that such a merger will be to the interests of the public, as well as of the stockholders. The majority of the capital of the Home Company is held by St. Louis men. In their petition to the Commission, they stated that the company had been a loser from its inception. The Commission finds this is true, and that the Home Company could not compete with the Bell Company, notwithstanding that it had a superior equipment, and ascribes this fact to a disinclination of the people to a double system of telephones. The verdict of the Commission was first held up because of opposition on the part of Attorney General Kuhn. The latter had some doubt as to whether the interests of the Detroit public were properly safeguarded by the terms of the merger. One of the clauses in the agreement is that the Bell Company shall not raise rates unless given permission by the State Railroad Commission.

CALIFORNIA.

The Railroad Commission has granted the application of the Half Moon Bay Light & Power Company for permission to operate in the Jefferson School District, in San Mateo County.

The Railroad Commission has granted the application of the Coast Counties Gas & Electric Company to purchase the capital stock of the Gilroy Gas Works for the sum of $25,000.

The Railroad Commission has granted a certificate of public convenience and necessity to the Great Western Power Company to exercise franchise rights for the distribution of electric power in Petaluma and Sebastopol, Sonoma County.

OKLAHOMA.

The Corporation Comission has issued a final order, effective September 20, requiring telephone and telegraph companies to furnish emergency service to state and county officers under conditions warranting it. It provides

that such service shall be furnished the Governor, members of the Supreme Court and Criminal Court of Appeals, Attorney-general, Corporation Commission, Adjutant-general, district judges, sheriffs, members of the Legislature when in session, and federal judges and United States marshals.

The Corporation Commission has refused to interfere in the internal difficulties of mutual rural telephone companies, holding that strictly mutual companies, not operated for hire, are not under the control of the Commission. The ruling was made in a case brought by William Gallant against the Four D. Telephone Company, a rural company making connections with the exchange at Perry, in which he asked that it be required to allow him to connect with its line. The Commission decided that it was a controversy over the ownership of a share of stock in the company and that it was not within its jurisdiction to determine property rights.

In the case brought by the Fort Supply Telephone & Telegraph Company against the Home Enterprise Telephone Company of Woodward, an order was issued with the consent and approval of the latter company, now controlled by the Pioneer Company, requiring it to make physical connection and give interchange of service.

The Pioneer Telephone Company was ordered to make connections with the Braman exchange and have it done by August 26.

Complaints have been filed against the Pioneer Company by L. S. Mayer, auditor of the commission, charging it with failure to file its monthly and semi-monthly reports. Such failure carries a maximum penalty of $500 per day and each day is considered a separate offense.

INDIANA.

The Indiana State Railroad Commission has inspected and approved eighteen miles of the roadway of the Indianapolis & Cincinnati traction line equipment with block signals. The company has been ordered to continue the installation of the signals on its line between Indianapolis and Greensburgh.

M. H. Hovey, block-signal expert for the Indiana Railroad Commission, who inspected the signal system almost completed on the Terre Haute, Indianapolis & Eastern line between Brazil and Greencastle, when a wreck occurred on August 14, filed with the commission a report of his investigation of the cause of the wreck. The switch where the accident occurred was left open by the foreman of the block-signal gang at work on the line.

NEW YORK.

The Public Service Commission, Second District, has completed an inspection of twenty of the twenty-six central offices of the New York Telephone Company in Manhattan which serve 327,840 subscribers or about 78 per cent of total number of subscribers within this main section of Greater New York. Public opinion concerning the service was carefully canvassed, and considerable complaint expressed by the users in some sections. Most of this adverse criticism was on account of getting wrong numbers and being subjected to "cut offs." No complaint was registered concerning the speed of the service nor concerning line and instrument troubles. The Commission's inspectors examined the equipment and central-office methods thoroughly and made record of over 2,500 test calls where speed of first answer by operators was found to be a fraction above five seconds. Special attention was given to the causes for the defective service which caused complaint, and the inspector's reports call the telephone company's attention to specific cases where there was found to be an overload and where there was a shortage of operators or too high a percentage of inexperienced operators. These matters have since been taken up in informal conference with the officers of the telephone company with the result of effecting a number of changes which will tend to improve the service.

The Commission has authorized the Suffolk Light, Heat & Power Company to purchase from the Riverhead Electric Light Company that part of its franchise and system which it now owns and operates in the town of Southampton, Suffolk County, and to exercise a franchise granted to the Riverhead Company. The Suffolk Company is authorized to execute a mortgage upon its entire property to secure the payment of its refunding and extension five-per-cent, 25-year gold bonds of the par value of $300,000. The company is authorized to issue presently bonds to the par value of $47,000 to be sold to bidders at not less than 85.

In the purchase of the Riverhead property the Commission finds the estimated reproduction cost of the property to be $15,000 and that the company is reasonably entitled to capitalization to the amount of $2,000 on account of the business now secured in that locality.

The Commission has granted the application of the Central New York Gas & Electric Company for permission to exercise franchises for furnishing of electricity in the towns of Geneva and Seneca, Ontario County; also, the application of the Syracuse Rapid Transit Railway Company for permission to exercise a franchise for single track construction from easterly line of Syracuse to Assumption Cemetery in the town of Salina.

Main Street, Quincy, Ill.

Washington Park, Quincy, Ill.

Quincy Installs Improved Lighting System.

Quincy, Ill., is one of the progressive western cities that believes in improved street lighting. This municipality has been adding to its electrolier system of street lighting and has installed 68 new posts this spring. The Des Moines Electric Contracting Company, of which J. W. Turner is president, was ordered by telegraph to equip several blocks of additional posts. The municipality is highly pleased with the rapidity with which this installation was carried out, and the excellent features contained in every detail of the construction. The accompanying illustrations show the lamps installed on Main Street and at Washington Park.

BOOK REVIEWS.

"Electric Lighting." By William Suddards Franklin. New York: The Macmillan Company. Cloth, 299 pages (5½x8½ inches), illustrated. Supplied by the Electrical Review Publishing Company for $2.50.

Prepared as a textbook for technical schools and colleges, this is a companion to the volume on "Dynamos and Motors" brought out three years ago by Professors Franklin and Esty. Like this earlier work, it aims to acquaint students with the principles underlying operating engineering and to familiarize them with some of the commercial aspects of central-station operation, current distribution and metering, outdoor and indoor lighting, storage-battery operation and telephony. The author's lucid style and the pains he has taken to be exact and dependable in his statements make the book unusually readable and easy of reference, while 63 sample problems will afford good practice for the students. But still more noteworthy is the extent of the footnotes, of which some ninety refer to technical journals or the published transactions of technical societies in which the reader may find a more detailed treatment of different items. Whether the references thus quoted are always the most pertinent ones, is open to question. Indeed, some of the important articles appearing in these columns seem to have been overlooked by Professor Franklin; as, for instance, the paper by C. J. Mundo[1] which showed the reasons for some of the variations in the foot-candle recommendations given on page 164. A glance through this volume shows it to be generally up to date, with a striking exception in its treatment of indirect lighting, in which the publications of the past 18 months preceding the issue of the book seem to have been overlooked. A cut of cove lighting is presented as typical of indirect lighting, which is dismissed from practical consideration by remarks like these: "The indirect system of illumination . . . should never be used where the walls and ceiling are liable to become even slightly discolored by dust or smoke." "The inverted arc lamp and diffuser . . . like every other device for indirect lighting, is too wasteful." Yet a preceding page tells of the eye-strain which may make a direct lighting system exceedingly wasteful in another way. However, the author repeatedly calls attention to the importance of manufacturers' bulletins, and if these are accessible to the students, they would offset such occasional slips. Whether the importance of wireless telegraphy and of electric-furnace work should not demand more than the mere reference to a few books on these subjects, is also open to question, though the volume seems well balanced otherwise and deserves a widespread introduction.

ALBERT SCHEIBLE.

1 Before the Association of Iron and Steel Electrical Engineers. Reprinted in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, November 4, 1911.

"Small Switches, Etc., and Their Circuits." By W. Perren Maycock. London: S. Rentell & Company, Limited, or A. P. Lundberg & Sons. Cloth; 286 pages (5½x8½ inches), illustrated. Supplied by the Electrical Review Publishing Company for 75 cents.

This volume deals with a subject about which comparatively little has been written, and there is unquestionably a place in the electrical field for a good book along the lines of this one. It is the practical electrician more than anybody else, however, who has need for this sort of treatise, and there is much room for doubt as to whether Mr. Maycock's book is entirely adapted to fill that need in America or not. The use of terms not very common in this country and the references to types of fittings little known here are so frequent as to make it quite probable that the average working electrician would get the idea that the book was not suited to the needs of the practical man. Nevertheless, the subjects treated are dealt with in an original manner, and, from the standpoint of electric wiring practice in England, this is undoubtedly the best work of its kind yet published. The first of the more important sections deals with what the author terms the art of switching, and contains many suggestions as to the best arrangement of switches for convenient and efficient control of lights in various classes of rooms. Then follow notes on the necessity for mechanical excellence in the construction of switches, plug connectors and other similar fittings. It would seem to be very unfortunate that in this discussion so much attention is paid to tumbler switches and other types of appliances little known except in the author's own country. The part of the book likely to be of most value to the electrical worker is that devoted to the control of lighting circuits and other circuits for delivering small amounts of power. There are dozens of diagrams showing how the connections should be made for various kinds and combinations of switches, and each diagram is rather carefully explained. The author's treatment of the connections for single-way, two-way, three-way and intermediate switches should prove especially helpful to the average reader. Some 30 pages are devoted to a detailed description of numerous types of plug connectors and adapters, and half as much space is taken up with ceiling rosettes. Switches for small motors receive due attention, as do also those for the control of electric heating apparatus. There are several pages on miscellaneous circuits, including those for charging storage batteries and circuits for lighting electric signs. The book is concluded with a short description of so-called demonstration boards, which, it is claimed, may be used to advantage in showing students different combinations of switches and circuits.

"Brazing and Soldering." By James F. Hobart. New York: The Norman W. Henley Publishing Company. Paper, 51 pages (5½ x 8 inches), 18 illustrations. Supplied by the Electrical Review Publishing Company for 25 cents.

Straight and to the point, this pamphlet of only fifty pages is far ahead of the larger works touching on the same subject, although its limited compass does not allow it to cover some important points, such as the advantages of electric soldering irons. Electrical men will miss in it a proper discussion of the reasons why certain pastes and other fluxes alone are approved by the inspection bureaus. However, they will find a large number of other points covered by the booklet, which is in Mr. Hobart's usual clear style.

ALBERT SCHEIBLE.

"Hand Forgings." By Thomas F. Googerty. Chicago: Popular Mechanics Company. Cloth, 197 pages (5 x 8 inches), 122 illustrations. Supplied by the Electrical Review Publishing Company for $1.00.

This is an admirable work and far more readable for Americans than the books of British authorship which have been available on this broad theme. Written for students and amateurs by an instructor in forge work, it is both practical and interestingly written, covering the methods of working and welding wrought iron and the designing of ornamental iron works. Over 200 sharp illustrations (mostly line drawings) speak for themselves, and some of them should prove suggestive to those interested in ornamental electric-light brackets. A few terms (like the word tuyere on page 25) have not been explained, but these shortcomings are so slight that anyone interested in the theme of the book will gladly overlook them.

ALBERT SCHEIBLE.

Greatest Coal Producer.

The United States has held first place among the coal-producing countries of the world since 1899, when this country supplanted Great Britain. In 1911 the total world's production of coal amounted to approximately 1,302,500,000 short tons, of which the United States contributed 496,221,168 tons, or 38.1 per cent.

FLASHING-OVER IN COMMUTATOR MACHINES: ITS CAUSE AND PREVENTION.[1]

By W. W. Firth.

By the term flashing-over is meant the formation of an arc with explosive violence between the brushes of a commutator machine subjected to abnormal conditions of load. In every case the flash-over appears to be associated with high current-density in the brushes and excessive sparking. The arc forms a low-resistance path between the brushes, and the machine is virtually short-circuited as long as the arc exists. The arc is carried away from the commutator surface chiefly by the magnetic action of the leakage flux, and is finally broken at the outer portions of the brush-gear. In motor or converter cases, however, the circuit-breaker may operate, and the arc is then extinguished by the withdrawal of the power.

Of all machines the converter is most subject to flashing-over, the usual cause being a short-circuit on the direct-current side. It also occurs frequently in motors subjected to excessive overloads or to accidental breaking of the field circuit; it seldom occurs in generators, probably for the reason that armature reaction on short-circuit greatly reduces the voltage across the segments.

In multipolar machines the flash sometimes extends around the circumference of the commutator, but as a rule is confined to certain pairs of brushes, a reason for which is suggested later. Flashing-over is a source of considerable anxiety to engineers because of the danger to attendants and the damage which usually results to the machine itself. The brush-gear is generally badly damaged, and often the machine is put out of commission for repair. A remarkable feature of the phenomenon is that the commutator is seldom, if ever, in the slightest degree injured in spite of the fact that the flash starts at its surface.

A valuable clue to the cause of flashing-over is afforded by a fact previously mentioned, that it is always associated with heavy initial sparking at the brushes. This may occur at any load, and depends upon the setting of the brushes; a machine set to run sparklessly at full load will probably not flash over at full load, but will do so on light load if a short-circuit develops in either case.

Now there are only two possible reasons for an arc forming between the brushes: either an abnormal rise of voltage or a decrease of resistance.

With regard to the former, it is conceivable that a large induced voltage may be generated in the armature by the sudden reduction of the current when a short-circuit clears, but the following calculation shows that such a result is very unlikely with the small inductances of commutator machines. In the motor on which the experiments of this paper were carried out there are thirty-three commutator segments between each pair of brushes, the thickness of the mica insulation being 0.075 centimeter, giving a total thickness of mica to be bridged over of 2.48 centimeters. Taking the low value of 20,000 volts per centimeter, the necessary flash-over voltage is 49,500. Now the induced voltage is $L\,di/dt$ where L is the coefficient of self-induction of the armature between a pair of brushes; the value of L measured by alternating current with the field unexcited is 0.034 henries, and the maximum rate of change of current during flash-over measured on the oscillogram is 8,000 amperes per second, from which the maximum induced voltage is 248 volts.

Further evidence that the flash-over is not due to a rise of voltage at the brushes is that if it existed the insulation of the armature would almost invariably be broken down, a result which does not occur in practice. This remark also applies to the possibility of a surge.

There is left only the second alternative, namely, the establishment of a conducting path between the brushes. Sparking produces burning and disintegration of the brushes; particles are released and carried round with the commutator and may develop into a chain of incandescent particles whenever the sparking becomes excessive; or it may be that the arc is merely started by particles of carbon across each pair of segments as they leave the brush and afterwards maintained by the voltage of the individual coils of the armature. An instance of the latter method of starting the flash may be quoted; old turbo-generators on which brass-wire brushes were used have been known to flash over when a wire has worked loose and bridged the segments some distance in advance of the brushes.

The theory of conducting particles explains why certain pairs of brushes are more subject to flashing than others; at the upper face of the commutator where the particles are held on by gravity flashing over would be expected more frequently than on the lower face where they can fall clear; the observed facts support this view. A 7.5-horsepower Westinghouse direct-current motor driven from 480-volt mains and loaded by a direct-coupled, 100-volt, 50-ampere generator almost invariably flashed over when the fully loaded generator was short-circuited through a 40-ampere fuse. In a number of tests the flash was always present between the upper pair of brushes, but none were observed between the lower pair; of the sides, the one running downwards was more prone to flash round than the rising one.

To reduce the damage to the brush-gear, conducting horns were attached to the two upper brush-holders with their free ends extended well beyond the frame of the machine and about six inches apart. Examination of the horns showed that the arc had traveled to their extreme points.

A photographic record of current and voltage to the motor at the time of flash-over made it quite clear that the flash was not started by a voltage rise, and was, therefore, due to the second cause, viz., a fall of resistance across the surface of the commutator. The establishment of such a conducting path between terminals across which a voltage of 480 is maintained is quite sufficient to start a current which instantaneously develops into a short-circuit. The arc is then blown out by the leakage flux, but another one is at once started unless the short-circuit has cleared; a succession of flashes occurs so long as the short-circuit lasts.

In the voltage record there are large fluctuations below the normal voltage terminated by a falling line as the machine comes to rest, the main fuse of the motor having blown during the short-circuit.

The current rises comparatively slowly at first, owing to the inertia of the armatures preventing an instantaneous fall of speed, but a point is reached where the current suddenly rises to a high value; this point probably represents the instant at which the flash-over started.

During the slow rise, sparking and disintegration of the brush-tips are increasing until the released particles are sufficient in number to form the conducting chain; until the fuse blows the arc is maintained by the supply mains, and afterwards by the energy stored in the revolving armatures. The maximum current recorded is nineteen times full-load current, and the energy absorbed is about 7,500 foot-pounds; the total time of flash-over is 0.4 second. The ripples in both voltage and current appear to be due to the varying length of the arc as it passes over the irregularities of brush-gear and horns.

Prevention of Flash-over.

These experiments indicate methods by means of which flashing-over can be prevented; either the current must be prevented from attaining an excessive value, so as to avoid disintegration of the brush-tips, or if the particles are liberated they must be at once removed

[1] Paper read at meeting of the Institution of Electrical Engineers, Newcastle-on-Tyne, England.

or prevented from moving across the surface. Inductance in the line has the effect of retarding the growth of the current and so allowing time for the short-circuit to clear, but it has been found that an effective choking coil for this purpose would be of prohibitive size and cost.

Cutouts operate too slowly to be protective.

A most effective solution of the problem has been attained by the author by the use of asbestos-faced wipers placed between the brushes and extending the full length of the commutator; with these wipers in position it was found to be impossible to produce a flash-over under the most extreme conditions of load and sparking. On short-circuiting the loaded generator a shower of flashes from the brush-tip traveled over the surface of the commutator to the wipers, where they were instantly quenched.

A further advantage in the use of the wipers is that the surface of the commutator is kept quite clean and normal sparking reduced to a minimum. The only drawback to their use is that they retain the carbon dust, and after a time become dirty; this results in some slight sparking under the wipers, particularly if set, as in this experiment, in the central position where the segments are carrying their maximum voltage. This points to the advantage of using thin wipers set close to the trailing tips of the brushes, and arranging them so that they may be easily cleaned or renewed.

Engineer Draftsman Wanted.

The United States Civil Service Commission announces an examination on September 11 and 12 at the usual places to secure eligibles for the position of engineer draftsman in the office of the Supervising Architect, Treasury Department, Washington, D. C. The salaries for this position range from $1,600 to $2,000 per annum. The duties of the position are confined to engineering problems in building construction. The examination will consist of practical questions based upon the work required. Applicants must have had five years of practical experience. Applicants should secure examination form No. 1312.

Exports of Copper.

Copper exports for the week ending August 15 totaled 5,620 tons; since August 1, 11,612 tons; same period last year, 15,908 tons.

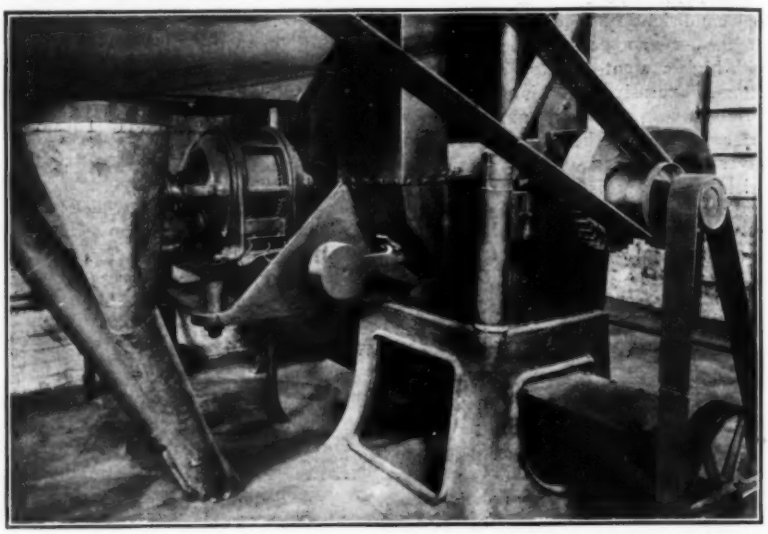
Ten of the largest single-phase locomotives ever built are now being manufactured for a Swiss railway. Each weighs 108 tons and can develop 2,500 horsepower at 50 miles per hour.

ELECTRICAL INSTALLATION AT THE PLANT OF THE ACME BREWING COMPANY.

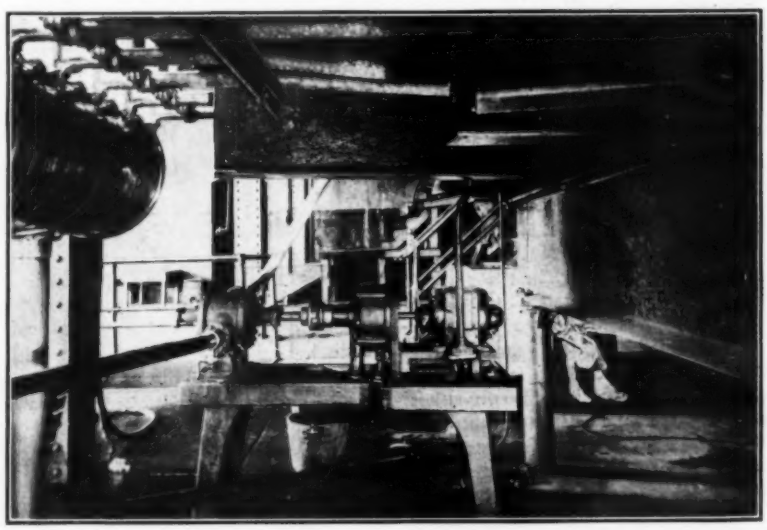
By V. V. Newell.

The plant of the Acme Brewing Company, at Macon, Ga., has during the past year been equipped throughout with induction motors for driving its machinery and some interesting problems were encountered during the work of making the changes. The brewery was enlarged several years ago and the old plant remodeled, bringing it up to date and making it a model in every respect for the purpose it was designed to serve. Its capacity was more than doubled, a 350-barrel kettle being provided, with all other equipment in proportion.

The power equipment which was provided at that time, with the exception of the ammonia compressors, consisted of two 75-kilowatt direct-current generators driven by reciprocating engines, the one belted and the other direct-connected. These units provided current at 220 volts for both power and lighting. A major part of the machinery was equipped with individual direct-current motors. This installation was quite satisfactory insofar as its reliability was concerned, but proved rather expensive. When, therefore, the Central Georgia Power Company made a proposition to furnish power at a rate which seemed very satisfactory, in comparison with the cost as produced by steam, it was accepted.



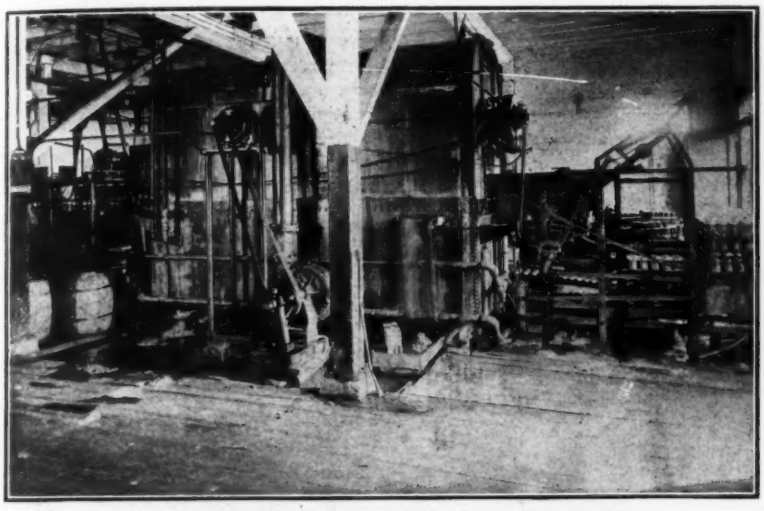
Induction Motor Geared to Malt Cleaning and Rolling Mill.



Motor Direct-Connected Through Gear Box to Mash Pump.

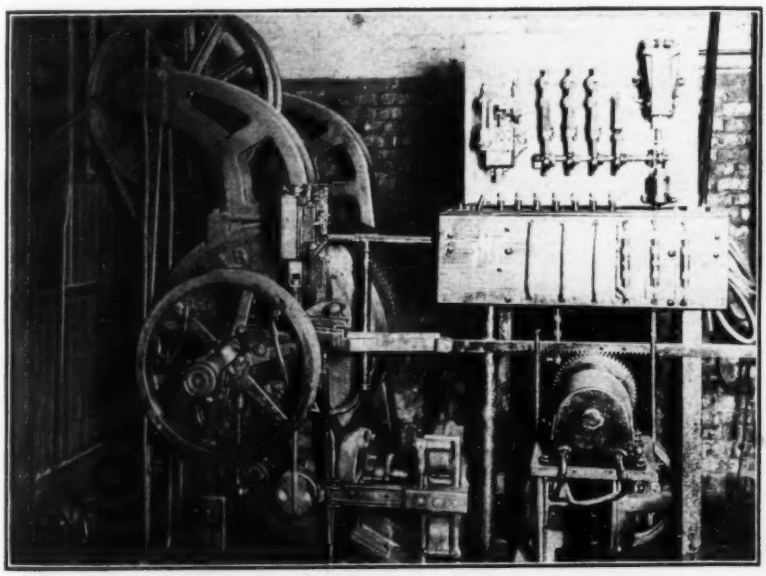
This company agreed to furnish cur-

rent at 6,600 volts, three-phase, 60 cycles, and this was transformed at the brewery to 550 volts. In order to make use of the old direct-current motor equipment, which was giving good service, one of the 75-kilowatt direct-current generators was direct-connected to a 100-horsepower induction motor and this motor-generator



Motor Operating Automatic Bottle-Washing Machine.

set, driven from the power company's circuits, was used to furnish direct current to the power and lighting circuits. When the bills from the power company began to come in, however,



Motor Direct-Connected to Two-Ton Elevator.

they proved to be much larger than was expected, while the bills for coal, oil, etc., were not decreased enough to make up the difference. Upon careful investigation it was found that most of the motors were from one-third to two-thirds larger than was required to handle the maximum loads placed upon them, and also that the motor-generator set during most of the day was loaded to only about one-third of its capacity. At night, when the entire load comprised only a few pumps and the necessary lights, the load was from one-fourth to one-sixth of the normal rating of the generator. From a careful inspection of actual operating tests it was estimated that a reduction of one-third in the amount of power required could be made by eliminating the motor-generator set and installing induction motors of proper capacity in place of the direct-current drives. A further saving could be assured owing to the decrease in expense for repairs and attention because of the simplicity of the induction motor.

It was decided to use 550 volts for all power purposes and 110 volts for lighting throughout the plant. Some doubt at first obtained as to the advisability of attempting the use of 550 volts in the cellar on account of the excessive moisture with the accompanying danger of insulation troubles. Up to the present time, however, not the least trouble has been experienced from the use of this voltage, and this is partially explained by the care which was taken in wiring the place. This wiring had formerly been run in conduit, but it was found that trouble was experienced by moisture getting into the junction boxes, causing excessive expense for repairs, besides interruption of the service. The wiring for both lighting and power was, therefore, changed to lead-covered open wiring in the cellar and other damp places where there could be any danger of moisture and the remainder of the circuits were carried in conduit.

Among the perplexing problems which presented themselves was that of a freight elevator of 4,000 pounds capacity used between the six stories of the brewery. This elevator, although used a great deal both for freight and passenger service, had always worked very smoothly with the 220-volt direct-current motor and gave little trouble. In order to operate this equipment from the alternating-current circuits a 15-horsepower induction motor was provided with wound rotor and a set of external resistances for purposes of acceleration. The old magnet for the brake was replaced by a solenoid suitably attached to the brake lever to provide electric control similar to that obtained with the magnet. This outfit provides a very satisfactory substitute for the original drive, the former mechanical features being retained.

The four beer pumps, which were all of the slow-speed rotary type, each with an individual motor connected to it through a speed-reducing mechanism, were also readily changed over to alternating-current drive. It was decided to use one motor in each cellar, driving the pumps by shafting and belts. The direct-current motor on each pump was therefore replaced by a suitable pulley and bearing and the two pairs of pumps were driven by two five-horse-power motors through moisture-proof belts. These twin drives provided ample flexibility and at the same time reduced the total horsepower required.

Another instance which illustrates the value of an accurate knowledge of power required for the various machines, is seen in the grinding room—the rolls for grinding malt were formerly driven by a 20-horsepower direct-current motor, but it was found upon careful tests that a 7.5-horsepower motor was sufficient for the

work. An induction motor of this capacity was therefore obtained, mounted in place of the direct-current motor and provided with a beveled pinion geared direct to the rolls of the grinder. This motor has been found to handle work very satisfactorily and, since it operates more nearly at its full-load rating, works at a higher efficiency than the old direct-current motor. This outfit is designed to clean and grind 100 bushels of malt per hour.

In the bottling works it was also found that the power required was much less than the normal rating of the installed motor. This drive was formerly provided with a 15-horsepower direct-current motor belted to the main shaft. Upon making actual tests it was found that the power consumed did not exceed 7.5 horsepower and an induction motor of this rating was consequently installed.

An air compressor in the brewery was also found to consume an excessive amount of energy. This outfit had been purchased at the time when air was used for pulling ice as well as for other purposes in the brewery and bottling house. Later on when the old air hoist had been discarded and replaced by an electric hoist, the compressor was, of course, much larger than was required for use in the brewery and bottling house alone. In order to maintain the desired air pressure in the receiver without using more power than was required, or involving an unnecessary amount of attention, a 15-horsepower motor was provided with an automatic pressure regulator designed to maintain air pressure between 40 and 50 pounds per square inch. As soon as the pressure reaches the predetermined maximum the compressor motor is automatically cut out until the pressure again falls to the lower limit.

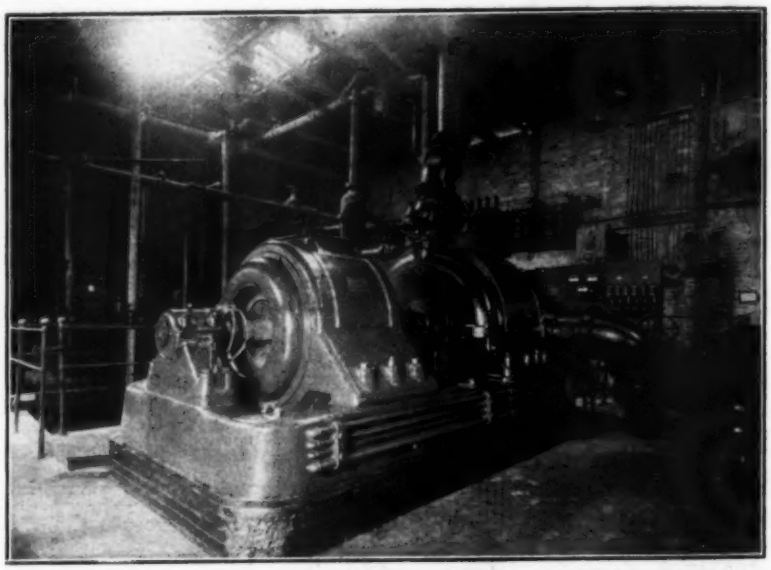
The motors used throughout the plant were manufactured by the General Electric Company and distributed as indicated in the accompanying list. The bills for power after the new installation was in operation were reduced about 50 per cent and the actual consumption of current about 60 per cent. The ready-to-serve clause in the power contract makes up the difference between percentage saved in money and that saved in current.

List of Motors.

Machine	Horsepower of Motor	Group or Individual	Number of Motors	Method of Connection	Remarks
Washing Machinery	7.5	Group	1	Belted	Moisture-proof windings
Tank Room Agitators	5	Group	2	Belted	Moisture-proof windings
8 by 8 Air Compressor	15	Indiv.	1	Belted	Automatic pressure regulator
Machine Shop	5	Group	1	Belted	Lathe, drill shaper, 2 stones
Centrifugal Pump	10	Indiv.	1	Direct-connected	350 gallons per minute against 30 pounds
Mash Tub	15	Indiv.	1	Geared	Capacity 16,000 pounds of material
Mash Conveyor	2	Indiv.	1	Geared	Back geared motor
Mash Pumps	2	Indiv.	1	Geared	Speed reduction gear box
Malt Cleaning and Rolling Machine	7.5	Indiv.	1	Geared	Direct to rolls
Blower for Grinder	1.5	Indiv.	1	Direct-connected	Special shaft extension
Beer Pumps (4)	5	2 Groups	2	Belted	Moisture-proof belts
Barrel Shop	2	Indiv.	1	Belted	Repairing kegs
Bottling Works	7.5	Group	1	Belted	
Mangle	2	Indiv.	1	Belted	For drying clothes
Triplex Pump	20	Indiv.	1	Belted	260 gallons per minute against 200 feet head
Centrifugal Pump	10	Indiv.	1	Direct-connected	Wash room
Carpenter Shop	15	Group	1	Belted	Saws, planer, etc.
Forge Fan	2	Indiv.	1	Direct-connected	Special shaft extension
Elevator (2 tons)	15	Indiv.	1	Direct-connected	Intermittent rated motor
Mash Dryer	10	Indiv.	1	Belted	
Grain Elevator	5	Indiv.	1	Belted	
Centrifugal Pump	5	Indiv.	1	Direct-connected	3,600 revolutions per minute
Centrifugal Pump	15	Indiv.	1	Direct-connected	
Ice Hoist	5	Indiv.	1	Belted	
Electric Crane				Self contained hoist and motor	
Total	199		26		

Waste Steam Drives Motors and Saves Power Bill.

In the plant of the Indiana Steel & Wire Company, Muncie, Ind., two 22-by-42-inch Bates Corliss noncondensing engines operate a series of wire-drawing benches. These engines receive steam at a pressure of 100 pounds from a battery of boilers consisting of four 150-horsepower and three 125-horsepower units. Each engine carries a load averaging 370 to 400 horsepower and operates continuously with the exception of Sundays and holidays. Sixty-cycle, 220-volt motors are employed to drive the machines which fabricate the wire into wire fencing, wire nails, etc.



750-Kilowatt 60-Cycle, Mixed-Pressure Curtis-Turbine Unit.

The electric power for the operation of these motors was formerly purchased from an outside source, but, in the early part of 1910, it was decided to utilize the exhaust steam from the Corliss engines to generate this electric power.

Accordingly a 600-kilowatt mixed-pressure Curtis turbine was installed and the exhausts of the two Corliss engines conducted to a common header, from which the turbine derives its steam at a pressure of one pound, gauge. The turbine exhausts into a Wheeler Condenser & Engineering Company's condenser which maintains a vacuum of 28 inches.

In case the engines are shut down, the mixed-pressure turbine is not affected, as it automatically cuts in sufficient high-pressure steam to meet its requirements. The turbine now carries the entire motor load of 600 horsepower, using steam that was formerly allowed to go to waste, and this economy has been effected without increasing the size of the engine room, the number of boilers or operators.

THE PLACE OF THE SMALL MOTOR IN MANUFACTURING.

By George J. Kirchgasser.

What is a small motor? What horsepower is the dividing line between the large-motor field and the small? If a motor for individual drive of a machine is considered, 25 horsepower is a large motor. For the general run of machine drive in the manufacturing plant, 15 horsepower or less is about the maximum capacity to be still considered a small motor.

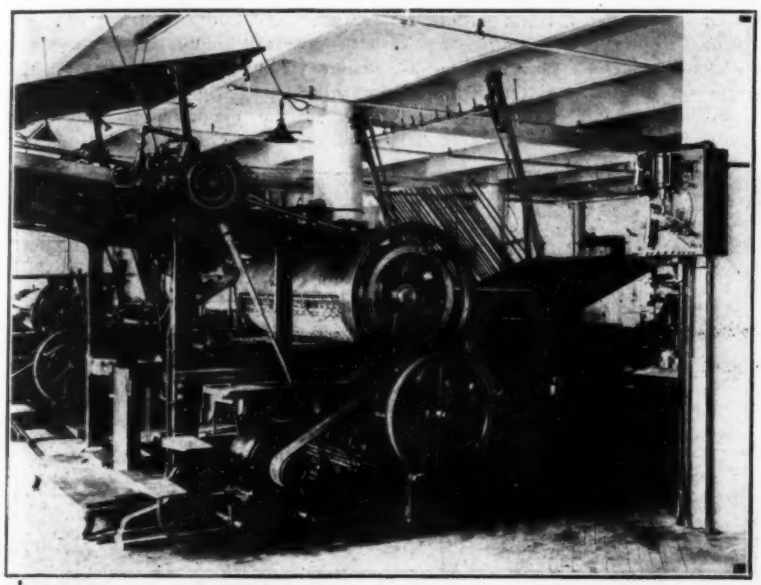


Fig. 1.—Miehle Press Driven by Five-Horsepower Motor.

Fig. 2.—Small Dexter Folding Machines with Individual Drive.

If we look to the large industrial plans, steel mills, ore and coal-handling machinery, or group driving, a 50-horsepower motor is a small motor. It is therefore necessary to arbitrarily select a line of demarcation. Drills, grinders, millers, lathes and planers usually require motors of from 1 to 10 horsepower. Even a large 84-inch rotary planer requires only a 15-horsepower motor. Although it is generally conceded that it is best to drive large tools by individual motors, it requires considerable argument frequently to get the manufacturer to see the advantage of using individual drive for smaller machines. There are many cases where group driving of small machines (used the greater part of the time, together), etc., is satisfactory and possibly cheaper, but the flexibility, ease and accuracy of control and independence are just as marked with small machines individually driven as with larger ones. The effect of power losses in shaft bearings, pulleys and belts is well known. Where alternating-current motors are to be applied, the power-factor must be taken into consideration and is an important factor in determining the kind of drive.

As a rule the small motors, especially those applied for individual machine drive, represent not only power to operate but a refined quality to be regulated. The huge motor represents somewhat more the physical power while the smaller motor is somewhat different.

Some manufacturers have confined their entire business to the making of small motors, using this as a talking point in selling their product. And it is a good point, as the designing and building of small motors must be very thoroughly done. A very small defect is much greater in proportion on a small motor than on a large motor of several hundred horsepower. Data on large motors is of little value in designing small motors. Also, in driving large or many machines, if the motor is 10 or 15 horsepower greater, it is not significant, as this is only a small per cent of the total.

The small motor must be built and selected for the particular work, and unless the manufacturer has made this his only line or has a department specializing on this work, the best results cannot be obtained. Excellence of electrical and mechanical design are required.

The efficiency, operating features, and sturdiness of small motors have been increased as the electrical engineer and central station exercise more care in selling the manufacturer "power service" rather than "current."

In the printing plant the small motor only is used, except perhaps in the largest newspaper plants. Miehle presses from the No. 4-0 down to the Pony No. 1 take from 3 to 1.5 horsepower. Job presses can all be run by motors from 0.25 up to 1 horsepower. The auxiliary machines, such as folders, lintotypes, molding machines, saws, trimmers, paper cutters, etc., are all well adapted for individual drive by small motors. Fig. 1 shows a Miehle press driven by individual Crocker-Wheeler motor and controlled by an automatic controller. The connections from the controller to the motor are run in iron conduit. From the motor to the small control stations on the press the control wires are carried in flexible conduit, making a very neat installation. Fig. 2 shows several fold-

ing machines, each individually driven by Watson 0.5-horsepower motors. The operator of each folder can start, stop or regulate the speed of the machine by means of a small regulator conveniently mounted on the folder.

Individual belt drive of a Scott offset press is illustrated in Fig. 3. The 3.5-horsepower Sprague motor is shown at the rear of the press with the Kohler automatic controller mounted alongside. The starting, speeding up, slowing down and stopping of the press is all accomplished automatically by means of the push-button station which can be seen mounted on the side of the frame of the press, convenient for the operator.

used exclusively. The small perforator, sewing machines and stitchers are driven by motors of not greater than 0.25 horsepower. Trimmers, numbering and paging machines, spindle punches, book saws, ruling machines, embossing and stamping machines, etc., can all be driven by motors with a capacity from 0.5 to 5 horsepower.

The small motor individually employed and requiring accurate control is also used in elevator work, as many installations require motors of only 3, 5, 10 or 15 horsepower. Fig. 6 shows an elevator machine driven by a 3-horsepower Wagner polyphase motor. A Schureman-type magnetic-brake solenoid is shown mounted beside the pound-wound to provide for the heavy starting duty.

It would be possible to take up one industry after another and show that the trend in power application is for the small motor individually driving its respective machine. This condition was prophesied years ago but even the most enthusiastic supporter at that time was somewhat skeptical. However, changes in the manufacturing field, competition, and the necessity for efficiency and excellence of product, have all helped to increase the demand for the small motor. All the machines that we are most familiar with in the manufacturing field are small-motor machines, which indicates

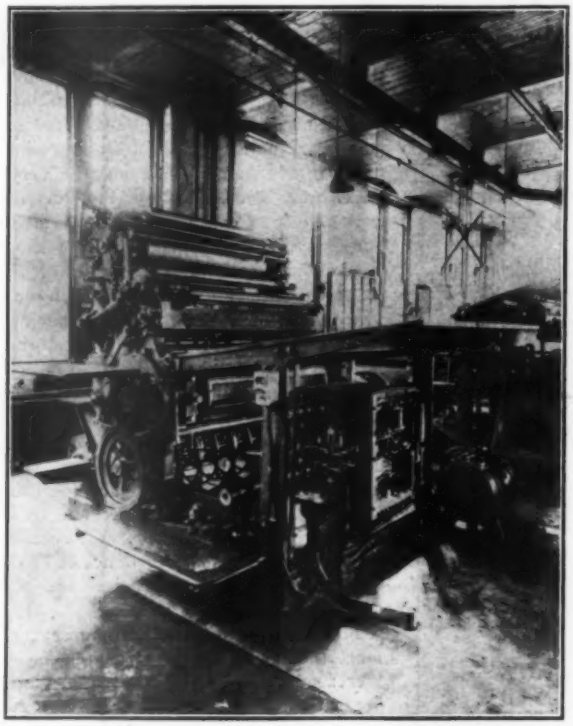


Fig. 3.—Rotary Offset Press with Push-Button Controller.

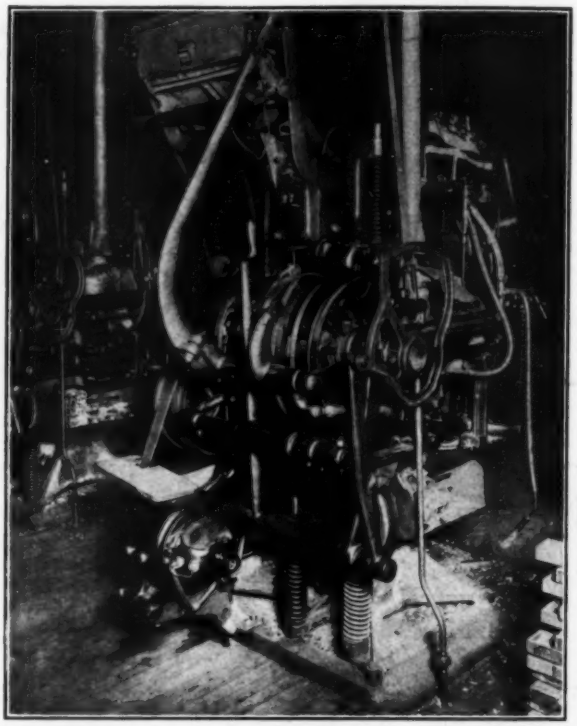


Fig. 4.—Monotype Machine with Half-Horsepower Motor Belt-Connected.

A belt-driven monotype machine, which has now come into great use in the printing industry, replacing much of the hand-setting of type, is shown in Fig. 4. These machines cast type and turn out line after line of copy in rapid time. Copy which is to be printed is first transcribed into a stencil by means of a stencil-cutting machine having a key-board similar to a typewriter. This stencil is then fed into the monotype and each letter is cast, formed into words and passed out in complete lines. The individual drive is particularly adapted for this machine and for the linotype, which is used for the same work. The motor, with capacity of 0.5 horsepower, drives the machine by means of a belt and idler arrangement.

In the bindery the small motor is winding drum, for slowing down. Machines used in laundries and dye works were at one time driven in groups. But many steps of progress have taken place in this business and individual drive is now being generally adopted. Starchers, band ironers, body ironers, mangles, dampeners, washers, extractors, etc., can all be driven by small motors. Fig. 5 shows three examples of individual small-motor drive in the plant of the Novelty Dye Works, Milwaukee, Wis. There is an exhaust fan, two washers and one extractor shown. Each washer is driven by a small reversing two-horsepower Watson motor, with back-gear transmission, making each a unit in itself. The extractor is also a unit, being driven by a Watson vertical inclosed motor, com-

the great future for this class of motor manufacture.

Some Experiences in the Tropics.

It is of course a well known fact that the design of electrical machinery for use in the tropics has to be surrounded with certain safeguards as regards heating limits, as compared with plant which is destined to operate in cooler latitudes, but it is doubtful whether in all instances the necessity for these precautions is fully realized, and it is therefore proposed briefly to mention two or three of the features in which this appears in actual practice. In order to put the matter as simply and easily as possible the points will be related in anecdotal form, the reader being largely left to draw his

own inferences as regards modifications in design which are necessary.

In one case in a gas-driven generating station operating in a hot climate, it was found that on one occasion the exciter on an alternator running in parallel with other machines failed and the consequences to the supply can easily be imagined. In the particular power house it was found that the temperature within the building averaged 104 degrees and it was at first suspected that something had gone wrong with the insulation of the exciter or the leads to the main generator, or that an earth had developed on the field of the generator. Tests, however, showed that the insulation appeared to be in good condition, and also there was no smell of charring or burning anywhere about the generator and the matter appeared to be rather peculiar until the trouble was finally traced to the commutator on the exciter. It was then found that this had become so badly carbonized as to cause all the coils of the armature to be short-circuited and such an occurrence amply explained all the rest. The commutator was cleaned by means of glass paper at intervals of half an hour, but even this on account of the excessive heat of the commutator due to the temperature conditions under which it was working, combined with the presence of a certain amount of gas in the atmosphere, made it impossible to prevent this fault from happening. Finally the commutator had to be taken out and turned up and after it was replaced and given a fresh start, it ran very well for a short time until the overheating again became apparent.

In the tropics, electrical discharges are very frequently met with and this is a feature which has to be especially guarded against in the installation of electrical machinery near the equator. In spite of the great care in design which characterizes the manufacture of lightning arresters, there are occasions when these do not operate with every success, and very great care should be taken in the selection of a good lightning arrester, should it be decided to install a high-tension overhead system. In one instance where a plant was constructed to generate at 5,500 volts for an overland transmission in South America, the trouble was so serious that each time a storm came on one or more of the coils in the generators were burnt out and, in spite of all attempts to rectify the matter by the use of other types of lightning arrester, the trouble persisted and became so serious that it was finally decided to rewind the generators and motors to a voltage of 500 to install transformers to step up to 5,500 volts for the transmission line, and to step down again at the other end. In this way no further trouble was caused to the generators, the transmission system being rendered an independent link so far as electrical discharges were concerned.

Special consideration should be given in the selection of plant for tropical climates, to the question of cable fittings and appurtenances, inasmuch as it will be found that in a good many types of junction box and similar gear, plant which was perfectly satisfactory for cold climates introduced a marked danger factor when used in the tropics. For example, in a large distribution box which was fed by three core cables, a lot of trouble was caused for the following reasons. The contacts for the fuses were made of pieces of one-sixteenth inch copper bent to the required shape, the grip between the fuse contact and the holders being obtained by the natural spring in these clips. This would be of course perfectly satisfactory under normal current-density conditions, and where a box was not subjected to external heat, but in the tropics the high atmospheric temperature combined with a good load on the distribution system, caused an undue temperature to be maintained on the fuse clips. On one occasion a temperature of 109 degrees was observed in the immediate vicinity of these clips and such conditions, combined with the somewhat frequent drawing and replacing of the fuses, impaired the electric continuity and the whole box became quite warm. These fuse contacts were supported on bases which were cemented into the main structure by means of sulphur cement, and similar supports also carried the weight of the busbars. Owing to the local heat together with the general temperature, the sulphur compound melted, the busbars became slack, and started arcing, and finally the copper contacts got red hot with serious consequences. In the particular instances noted the installation was utilized for mine-pumping purposes and the interruption of supply caused by the giving way of this sulphur cement, was a most serious matter until the pumps could be gotten started again. Consequently the particular junction box mentioned had to be dismembered and the bases were mounted on plates of mica of several thicknesses to do away with the use of sulphur cement.

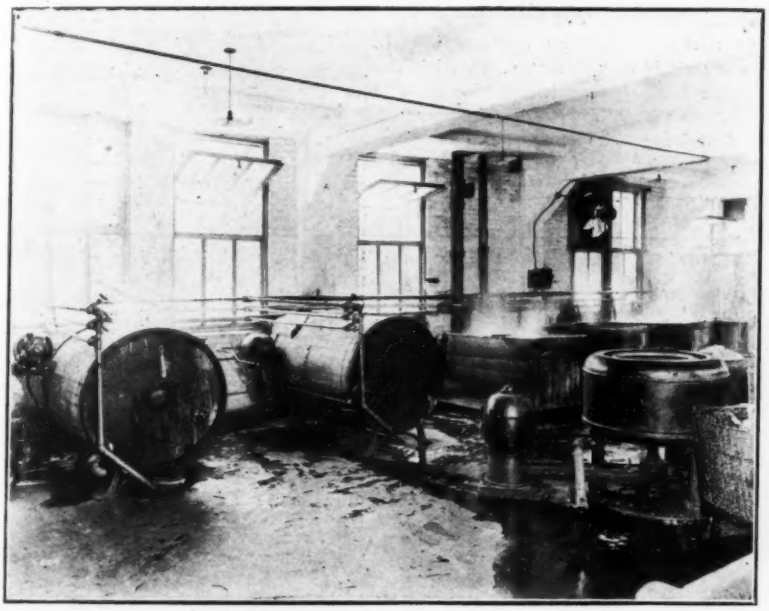


Fig. 5.—Two Washers and Extractor with Individual Motors.

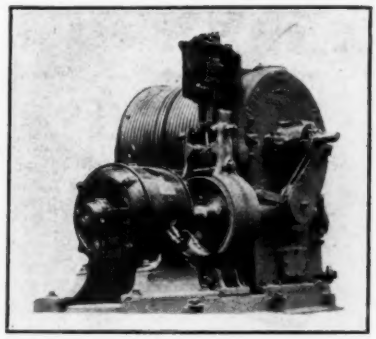


Fig. 6.—Elevator Motor.

Next Convention of Telephone Pioneers.

It has been decided to hold the second annual convention and reunion of the Association of Telephone Pioneers of America at New York City, November 14 and 15. Henry W. Pope, New York City, is secretary and treasurer.

New Electrical and Mechanical Appliances

A Sectional Concrete Pole.

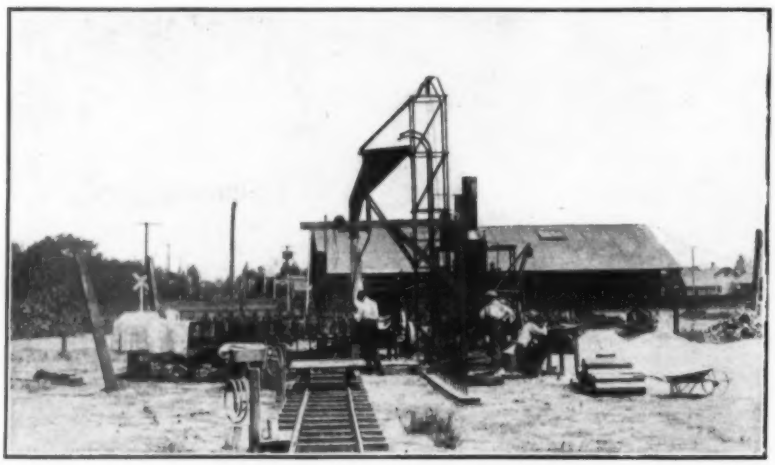
The American Orr Concrete Pole Company, Incorporated, of Anaheim, Cal., is now manufacturing a sectional concrete pole. The purpose of this company is to supply concrete poles in the place of wooden poles. Its sectional concrete pole is fully covered by United States patents.

Differing from any other concrete pole manufactured, it is made in sections, each section being nine inches in length, and of any diameter necessary. It is reinforced throughout its length with four, or more, steel rods. These rods are dipped in liquid asphaltum before using. This is for purpose of preservation from rust or corrosion. Beginning at the base of the pole, these rods are securely fastened in the cement so as to afford an anchor. The first six feet of the pole are made in solid form; and the first length of rods is 11 feet 6 inches. From this length on, the rods are cut in lengths sufficient to pass through four sections of the pole, or 35.9 inches long. The rods are all tightly fastened together by means of malleable-iron Orr buckles, 1 by 3 inches, with a center core, made especially for this purpose. The concrete sections are reinforced with No. 6 annealed black wire, coiled in each section. The cement is mixed with crushed rock, from one-quarter to three-quarters inch in size. The sections are made singly, and are set and cured before placing them in the pole. As the sections are placed in position liquid cement is spread over their end surfaces to keep out all moisture. The molds for making the concrete sections are numbered in consecutive order, and have sufficient taper, from base to top, to give the pole, when erected, a slight conical shape, approximately one inch to every ten feet of the pole.

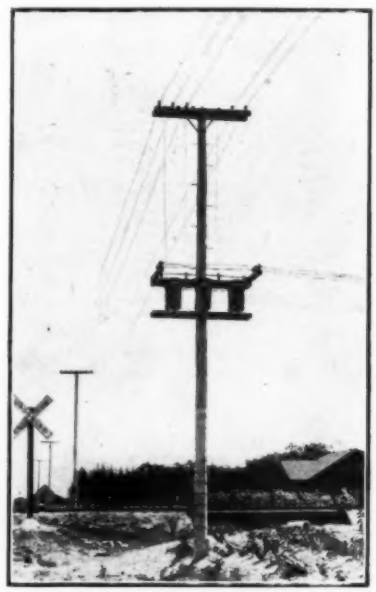
To erect the pole, the base is first made, using the dug-out in the ground as a form, after which a section at a time is put in place until the desired height is reached. The buckling of the rods takes place every four sections, as the pole is being erected. Provision is made for steps as the sections are made. The pole can be manufactured and erected in about one week's time. The number of poles that can be made at one time depends upon the equipment on hand. The company has just installed a machine at Anaheim, Cal., which will enable it to manufacture on an average 24 poles per day, working the full 24 hours. This plant is equipped to build a 50-foot pole.

The sectional concrete pole can be used for any kind of constructionrailway, telephone, power, or high-tension. The sectional nine-inch pieces can be taken into the roughest country at small cost. The aerial construction is as usual—wooden cross-arms fastened on by U-bolts, and the strap braces fastened by collar bolts. This leaves the construction so that it can be changed to higher poles by adding on more sections at any time. They also can be lowered at any time by simply taking sections off the top.

The company does not sell the machines, but leases them to operating companies, on a small royalty basis.



Making the Sectional Concrete Poles.



A Pole in Use.

Double-Decked Trolley Car.

The success of the center-entrance, stepless car, which has been in operation on Broadway, New York City, has induced the New York Railways Company to adopt a new form of center-entrance, double-decked car. The new double-decked car has a seating capacity for 88 passengers, with stairways at each end connecting the upper deck with the main portion of the car. The conductor is seated at the center of the car, where there is ample standing space for assembling passengers in front of the money-changing desk, so that the time for stops may be reduced to a minimum. Longitudinal seats are installed in the lower compartment and also in the upper deck. The stairways are inclosed and the upper deck can be operated as an open-air and smoking section, or can be inclosed. Means have been provided for announcing the streets to the upper compartment

through a specially designed electric announcer.

The Cooke system of ventilation has been adopted. The varying weight of the passenger load automatically supplies the required quantity of air per passenger by regulating the strength of the fan-motor field. Three hundred and fifty cubic feet per hour of fresh air is provided per passenger. The temperature will be regulated by means of thermostats. The braking power is also automatically governed by the weight of the passenger load.

The height of the car from rail to top is 12 feet 10 inches; width over all, 8 feet 3 inches; length, 44 feet 10 inches.

The Hughes Expansion-Wire Arc Lamp.

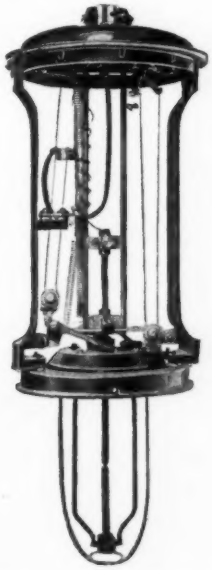
To Charles C. Hughes, of Philadelphia, belongs the credit of bringing forth a successful expansion-wire electric arc lamp. The lamp is of the non-magnet type, the light being controlled by the use of an expansion wire, which was developed after a number of years of experimental work, the wire being such that the continual expansion and contraction does not permanently alter its length. When the current is first thrown on, the wire expands sufficiently to draw a good arc. As the carbons burn away and the current decreases, the wire contracts and trips the carbon clutch, thus feeding the carbon.

Hughes Arc Lamp.

The lamp forms no inductive load when used on an alternating-current circuit, thereby giving the central station the full benefit of the current generated. The lamp burns equally well on direct or alternating currents, and is especially adapted for factory and other uses, where there is used a direct-current system during the working hours, and it is desired, should the direct plant be shut down for any cause, to throw over to a central plant, the supply from which is alternating.

Since the lamp is constructed without either dashpot or magnets, a great source of expense and annoyance has been done away with. The absence of dashpot and magnets also eliminates the troubles which arise from vibration, this being entirely overcome. The heaviest vibration will not break the arc or even cause the light to flicker. This makes this lamp especially desirable for forge shops, foundries, etc.

The interior parts are made of a non-corrosive metal, which makes the lamp desirable in places where acid or other fumes and vapors cause trouble, such as in chemical works, sea-shore resorts, railway roundhouses, etc.



Interior Mechanism of Arc Lamp.

The construction of this lamp is such that any fluctuation of voltage to the extent of 25 per cent does not affect the operation of the lamp, the only difference being in the amount of illumination. This is a very desirable feature in places where voltage fluctuation is unavoidable, due to the excessive intermittent load being thrown on the circuit. This lamp can be used on any frequency from 25 to 140 cycles without change in construction.

The efficiency of the arc and the life of the carbons is the same as that of any inclosed arc lamp. The lamp giving a very steady light, the candlepower is much higher for the same wattage consumption. The inventor claims that such a lamp does away with nine-tenths of the repair bill, the life of the wire being at least at great as the life of a set of magnets, and the cost of replacing negligible.

Broad basic patents have been granted to Mr. Hughes on both the expansion wire and lamp. Mr. Hughes has organized the Hughes Universal Arc Lamp Company, capitalized at $200,000, under the laws of Delaware, and has equipped a factory at 628 Race Street, Philadelphia, which is in position to fill orders promptly.

The Monarch Vacuum Cleaner.

The Monarch Vacuum Cleaner Company, 1151 Broadway, New York, N. Y., has put upon the market a featherweight vacuum cleaner, which is claimed to be the most efficient one made. The motors for this cleaner are supplied by the Robbins & Myers Company and are furnished for either direct or alternating current. The turbine fan revolves 3,600 times and displaces 112,000 cubic inches of air per minute, the motor being one-eighth horsepower. The metal parts are made of an aluminum alloy, which makes it very light and easily portable. Among the many attachments is one for cleaning windows.

Interior of Monarch Vacuum Cleaner.

A French metallurgist has manufactured an alloy with the hardness of steel and great tensile strength, by the addition to copper of chromium, aluminum, nickel and zinc at certain temperatures, which are maintained for specfied lengths of time.

Church-Field Electric Vehicles.

The Church-Field Motor Company, Sibley, Mich., has put upon the market a line of electric vehicles which includes an electric coupe, illustrated herewith. This machine has an underslung body and the battery is carried between the axles. A distinctive feature of this vehicle is a special two-speed transmission gear of the planetary type, which, it is claimed, puts the electric vehicle on an even footing with the gasoline car in climbing hills. It minimizes the wear and tear on the batteries and effects a marked saving in the consumption of current. While widening the efficiency and usefulness of the machine it materially decreases the cost of maintenance.

The maximum speed of the machine is 30 miles per hour and the economical speed under high gear is from 15 to 17 miles per hour. By means of the two-speed transmission the car is at the same time well adapted for heavy road work and for hill climbing. The transmission-gear reduction is two to one, making a total reduction on low gear from motor to rear axle of eight to one, the rear-axle beveled gear giving a reduction of four to one. Other gear ratios can, however, be supplied for the rear axle.

The controller is a non-arcing safety-interlocking type with only three moving contacts, and gives ten speeds. While it might seem that the speed on the low gear would be half that for the same point of the controller on high gear, this is not the case, owing to the fact that the motor is series wound. Thus on the fourth control point the speeds will be approximately 16 and 12.5 miles per hour. Due to the overlapping of the two ranges of speed at high and low gear, the ten points of control actually give about 15 separate speeds.

The motor is especially manufactured for this car by the Wagner Electric Manufacturing Company. It is rigidly mounted in the center of the chassis and is connected with the rear axle by a shaft giving a straight-line drive.

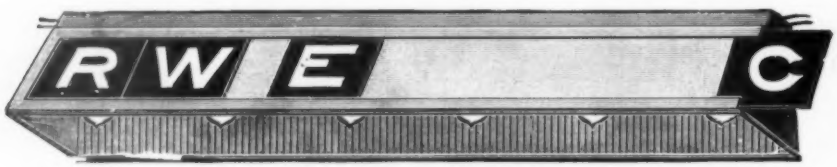
The batteries are not used in parallel at any point of control. On the fourth point there is a straight series connection. From the fifth to the tenth point the motor field is shunted. The efficiency of the motor in this range is claimed to exceed 80 per cent. There are 26 cells of battery having a capacity of 180 ampere-hours.

The car has a long wheel base and special springs of vanadium steel. The machine is equipped with two focusing headlights, an electric horn and other standard equipment.

Church-Field Electric Coupe.

Witz System of Window-Sign Reflectors.

The accompanying illustration shows a new system combining a window sign with a reflector which has been designed by Robert Witz and which is intended to do away with the ordinary painted signs on shop windows. When the paint wears off of the ordinary painted window signs every spot is noticeable; and they are not usually legible at night, for even though transparent lettering be used ordinary systems of window lighting generally throw shadows on the letters. In the Witz system the letters are brilliantly illuminated and the reflectors at the same time throw light on the merchandise which is being displayed in the window, the two objects being thus secured with one set of lamps. The letters can be changed very easily and any kind of reading matter displayed. This is especially useful when special sales of goods are being held, or where special brands of merchandise are being carried. In high windows this outfit can be lowered to the desired point and the merchandise in the window can be very much better lighted than when the lamps are in the top of the window. Letters are made of solid blue and of solid red, which, when used alternately, are considered to make the most attractive sign.



Witz Window-Sign Reflector.

New P. & S. Fittings.

The two accompanying illustrations show two new fittings that have been put on the market by Pass & Seymour, Incorporated, Solvay, N. Y. Fig. 1 is a brass-shell socket with a three-eighths-inch cap and is made for the large-base lamps of 500 watts. The same socket is also made with a half-inch cap. The shadeholder is rigidly and permanently attached to the shell. Both cap and shell are of substantial brass and threaded with a fine thread. A set screw is provided on the cap, so that the lower shell cannot back out of place. The center spring contact is of heavy phosphor-bronze. The fiber lining may be readily removed for the purpose of refinishing the shell. This device is supplied either with or without the Shurlok locking attachment.

Fig. 2 illustrates an outlet-box receptacle, designed for use with large-base 500-watt lamps, complete with shadeholders rigidly attached. The receptacle sets down into the outlet box and the contact terminals are arranged so that they may be used without cutting the wire. It is easy to loop the conductor up where single or twin conductor is used.

Fig. 1.

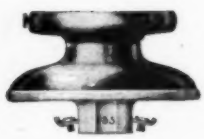


Fig. 2.

Utilizing Remnants of Arc-Lamp Carbons.

Six years ago the lighting plant of the Bavarian State Railway, at Angsburg, began the practice of cementing the stubs of arc-lamp carbons to each other so that eventually the entire length of every carbon would be consumed. The method was gradually improved and since the legislation of 1909, which placed a heavy tax on arc-lamp carbons, it has been adopted by many of the larger municipal and industrial plants of Germany.

In practice, the stub which formerly was thrown away, is cemented to one end of a new carbon of the normal length for the lamp, the stub end being inserted in the holder. When this

lengthened carbon has been burnt, it leaves a new stub of about double the length formerly customary. This in turn is cemented to the end of a fresh carbon which is so inserted in the lamp that the joined stubs will be consumed first.

For squaring and joining the carbon ends, the German firm of Gustav Schacke has built a special trimming outfit. This consists of a lever-operated cutter for roughly cutting the carbons to about the desired length, and a motor-driven abrasive wheel for grinding the ends square. The tip of the carbon is inclosed within a hood during the grinding, so that the apparatus causes practically no dust. When the ends have been squared, they are cemented together with a special compound and are set vertically into holes in a board after the manner of twist drills in a machinist's drill set. Twelve hours' standing is generally sufficient for hardening the cement. To test the firmness of the joints, several of the cemented carbons are taken together and

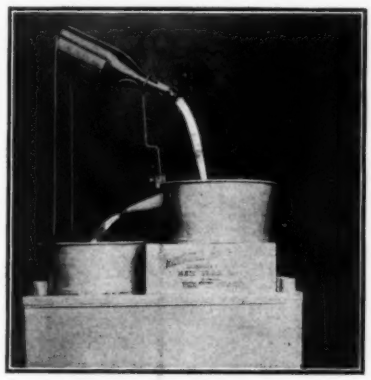
One of the Beautiful Fountain Figures.

rattled in the hand. Then a clear, ringing tone indicates a solid joint, it being claimed that the built-up carbons break less easily at the joints than elsewhere.

The time required for this assembling of carbons and stubs is so small that some employee of the plant can usually attend to it along with his other duties, as with such an outfit one man can make two hundred joints per hour. Considering the man's wages, the cost of current for the motor and of cement for the joining, as well as the interest and depreciation of the apparatus, it is claimed that by this method of utilizing the stubs they cost only 30 per cent as much as their equivalent in new carbons.

The Everflowing Bottle.

That enterprising storekeepers are rapidly beginning to realize the inestimable advantage of an attractively arranged window to aid them in selling



Everflowing Bottle.

their wares is well exemplified by the use of the device described below. People like to be amused and they like to be mystified, so that any device which has motion and affords a mystery too, secures their undivided attention.

Crowds of people thronging the streets of several Eastern cities have been puzzled by the sight, in various store windows, of a vessel suspended in the air and from which there is a continuous stream of liquid flowing into another vessel or receptacle placed beneath the under one. There is no visible means of inflow to the bottle.

Electric Fountain in Salem.

This device, which is called the Everflowing Bottle, is manufactured by the Mercantile Advertising Company, of New York City. It can be used to represent the flow of any liquid from any kind of a vessel.

The device has been successfully used by many merchants in window displays to represent the flow of wine, beer, grape juice, oil, and various other fluids, the sales of which have been very greatly increased thereby.

The motor driving the pump has a capacity of 0.5 horsepower and is made by the Westinghouse Electric & Manufacturing Company.

An Electric Fountain for Salem.

The accompanying illustrations give some idea of the new electric fountain which has been installed at Salem, Ore. This fountain is a gift to the city of Salem by the late Mrs. E. M. Waite, who wished thus to commemorate her husband, one of the pioneer printers of Oregon.

The center urn of the fountain is 19 feet in diameter and 10 feet high. The outer basin is 68 feet long and 35 feet wide. The sprays are furnished through 590 nozzles which play to varying heights up to 60 feet. A 10-horsepower motor inside the fountain drives a pressure pump operating at a pressure of

Another of the Fountain Figures.

80 pounds, serving about 23,000 gallons of water per hour. The various figures formed by the nozzle streams are arranged automatically by varying the pressure and the deflection of the nozzles. Variegated color effects are provided through the utilization of colored lamp bulbs and flashing devices.

The electrical and mechanical effects for the fountain were designed and built by F. W. Darlington, of Philadelphia, Pa. Mr. Darlington is well known as the designer of fountains of every description and magnitude in every part of the country. The cost of the fountain was $8,000. Mr. Darlington is at present making his headquarters at 4937 Kenmore Avenue, Chicago, Ill.

Westinghouse Power-Factor and Frequency Indicators.

A poor power-factor can often be improved by a better proportioning of the motors to their load, the use of a super-excited synchronous motor or similar means, with resulting increased capacity and efficiency of the system. It is therefore important, particularly in heavily loaded plants, to know what the actual power-factor is at various conditions of load. To do this, it is not necessary, as it once was, to take readings of voltage, current and power and to calculate from these the ratio of true to apparent watts. The introduction of direct-reading power-factor indicators has made calculation unnecessary and enables the determination of the power-factor without trouble. Their use indicates whether induction motors on a system or on any circuit of a system are being properly operated, and enables the adjustment of the exciting current of synchronous apparatus to values giving the most economical power-factor.

On polyphase systems supplying a mixed load, power-factor indicators are a necessity, as the calculation of power-factor from other instruments is complicated and difficult and may give very misleading results. A polyphase power-factor indicator having current connection in each phase of the circuit will indicate the average power-factor of all the phases.

Fig. 1—Power-Factor Meter.

one phase of the circuit. As the iron vane is attracted or repelled by the rotating field of the current coils, it will take up a position where the zero of the rotating field occurs at the same instant as the zero of its own field. Thus its position will always indicate the phase angle between the voltage and current of the circuit. The pointer attached to the armature, therefore, indicates this angle, and, by marking on the scale the cosine of the angle shown by the graduation, the power-factor is read directly. In the three-phase instrument the rotating field is produced by three current coils spaced 60 degrees apart; in the two-phase instrument, by two current coils spaced 90 degrees; in the single-phase instrument the position of voltage and current coils is interchanged and the rotating field is produced by means of a split-phase winding.

Fig. 2 illustrates the movement of a type SI seven-inch power-factor indicator. The winding shown within the iron ring is the stationary winding of the current coils. Inside this, and not shown, are the stationary voltage winding and the pivoted armature. The laminated-iron ring surrounding the winding is provided as a return circuit for the flux of the pivoted armature, so that the reluctance of the armature magnetic circuit is low and uniform in all positions. These parts are shown in the diagrammatic cross section, Fig. 3.

The aluminum disk shown in Fig. 2 at the front of the instrument, is a damping disk moving in the concentrated field of the two permanent magnets at the bottom of the mechanism. These magnets and disk have no effect whatever on the electrical operation of the meter. They serve to absolutely prevent oscillations of the pointer, and thus make the readings dead beat. The pointer, therefore, does not swing back and forth but comes to rest at once at its correct position. More efficient damping is obtained with this electromagnetic device than is possible with air damping devices unless a delicate and easily deranged adjustment is resorted to.

It will be noted that in this form of power-factor indicator no connection is required between the fixed and the moving elements, nor is any control spring necessary, as the controlling force is electromagnetic. The moving element is very light, therefore, and the friction and bearing-jewel wear a minimum.

All the Westinghouse switchboard types and the polyphase, portable types are arranged to read lagging or leading power-factor on the upper half of the scale, and for reversed power on the lower half. The switchboard types are adjusted for one standard frequency; the polyphase portable instruments are adjusted to any frequency between 25 and 60 cycles. The single-phase portables indicate for 60 cycles on one-half the scale and for 25 cycles on the other half. The portable indicators are very convenient for investigating the power-factor of motor loads and assist very materially in improving the operation of the system.

The Westinghouse frequency meters, new types of which are illustrated on the next page consist of two induction-voltmeter elements, *A* and *B*, Fig.

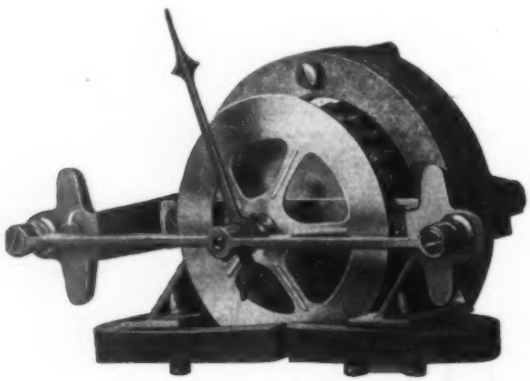


Fig. 2—Movement of Meter.

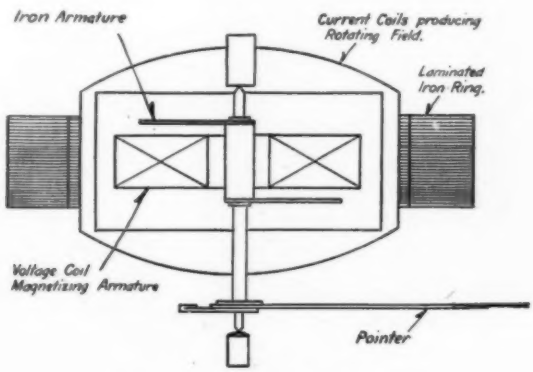


Fig. 3—Diagrammatic Cross-Section.

The illustrations show two types of direct-reading power-factor indicators manufactured by the Westinghouse Electric & Manufacturing Company. These instruments indicate on a graduated scale the power-factor in the circuit to which they are connected.

The power-factor indicator operates on the rotating-field principle. A rotating field is produced by the current of the metered circuit passing through angularly placed coils. In this rotating field is situated a pivoted iron vane or armature, magnetized by a coil whose current is in phase with the voltage of

4, acting on a disk *G*, and tending to move the disk (and the pointer shaft) in opposite directions. One of the elements is in series with a resistor *H*, and the other in series with a reactor *I*, so that any change in the frequency tends to change the relative strength of the two magnets and cause rotation. The disk is so shaped that, as it moves, the amount of its metal under the strongest magnet becomes less than that under the weaker magnet, so that with every relation between the two magnet strengths there is some point where the torques produced by the two magnets balance and the pointer comes to rest. Magnet *A* tends to turn the disk in clockwise direction, and magnet *B* in the opposite direction.

The torque of each magnet is proportional to the square of the current in the coil and to the frequency. At normal frequency, the torques balance when the disk is in the middle position. If the frequency increases, the current in coil *A*, which is in series with resistance only, remains unchanged and its torque increases because of the higher frequency; the current in coil *B*, which is in series with reactance, diminishes and its torque diminishes correspondingly. The disk, therefore, turns toward the right. For similar reasons, if the frequency decreases, the disk turns toward the left.

If the periphery of the disk were a true circle, any change in frequency which would cause the torques of the two magnets to be unequal would produce continuous rotation in one or the other direction. The disk is, therefore, made of a special shape. The left-hand edge of the disk, which moves under magnet *A*, is practically the arc of a circle, having its center at the shaft. The right-hand edge, which moves under magnet *B*, is practically the arc of a circle with its center slightly above the shaft. With this arrangement, the amount of metal in the air gap of *A* is always practically the same, while the amount of metal in the air gap of *B* depends on the position of the disk. When magnet *B* becomes relatively stronger than *A*, owing to low frequency, the disk turns toward the left and the amount of metal in the air gap of *B*, and consequently the torque of *B*, gradually decrease until the torques of the two magnets balance, when the disk stops. When magnet *B* becomes relatively weaker than *A*, owing to high frequency, the disk turns toward the left and the amount of metal in the air gap of *B* and consequently the torque of *B*, gradually increase until the torques of the two magnets balance, when the disk stops. For every frequency there is a definite point at which the disk comes to rest.

As actually constructed, the edges of the disk are not true circular arcs. The shape is determined experimentally, so that a uniform scale will result.

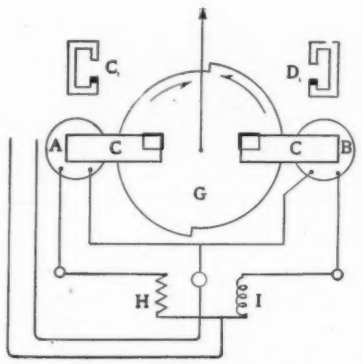


Fig. 4.—Diagrammatic Representative of Frequency Meter.

Any change in voltage applied to the two voltmeter elements changes the current in both of them in the same proportion, so that their relative torques are not changed. The meters are, therefore, unaffected by voltage changes within wide limits.

The moving element consists of the meter disk, the pointer, a counterweight, and the shaft. This element is so balanced that the pointer will remain in any position when no current is on the windings. The pivots of the shaft, which are of specially hardened and polished steel, rest in jewel bearings. The entire moving element can be easily removed.

No control spring is used, as all the forces controlling the movement of the pointer are electromagnetic, which results in permanent calibration.

The pointer is of U-shaped cross-section and has considerable strength. Spring stops acting on the disk at each end of the swing prevent damage to the pointer, which might otherwise result from the sudden application of current at a frequency outside the range of the meter. In the round-pattern meters, the entire pointer is clearly visible, and any change from normal frequency, which is at the center of the scale, can be noted quickly, even from a distance.

The bearings are mounted on a rigid casting secured to the meter case. The jewels are mounted in adjustable screws.

The cases of the round-type meters match in size and appearance the seven-inch and nine-inch alternating-current and direct-current meters made by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. The line of seven-inch meters is

Fig. 5.—Frequency Meter.

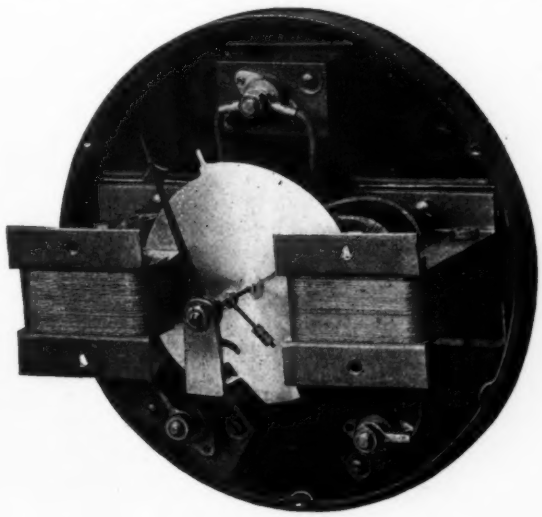


Fig. 6.—Interior View.

particularly notable for its great saving in switchboard space. Vertical edgewise and portable frequency meters operating on the same principle are also manufactured by this company.

Dictating Letters by Telephone.

A new and original use of the telephone in commercial life, says the *New York Telephone Review*, has been made in the stenographic and typewriting department by Lord & Taylor, the large dry-goods firm in New York.

Formerly when any one in the offices or different departments of the store required the services of a stenographer it was necessary to summon one, thereby losing much valuable time in giving the dictation.

Not only has all of this been done away with, but it has been found that efficiency has been increased many fold by the use of the telephone. To meet the requirements of Lord & Taylor the New York Telephone Company designed a special table provided with five typewriting positions on each side, and in the space extending down the center of the table and in front of each stenographer's position an annunciating drop and spring jack are installed. Each of the ten typewriting positions is equipped with a breast transmitter and a head receiver terminating in a plug, the same as used by telephone-exchange operators. This leaves the hands of the stenographers free either to take notes or to write directly on the machines as though the person dictating were sitting beside them. A sub-switchboard is connected with this table and also with the main switchboard in the store. It is only necessary for any one wishing to dictate to lift his telephone receiver, say "Stenographer, please," and be connected with that one of the ten stenographers who is least engaged. Often the work is completed in less time than it heretofore took the stenographer to reach the point where the dictation was to be given.

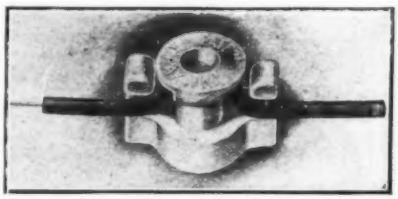
Electric Propulsion for Large Lake Boat.

An order has been placed by the Montreal Transportation Company with John Reid & Company for an electrically propelled vessel for lake traffic. The vessel will be of 2,400 tons and 300 horsepower.

The engine will be of the Diesel type and will drive alternating-current generator whose power will be applied to large induction motors connected to the propeller shaft, which will have a speed of about 80 revolutions per minute. Control will be had by means of switches mounted on the bridge.

New Insulator for Interior Work.

The accompanying illustration shows a new form of porcelain insulator for interior construction, which holds a wire or cable securely in place without the necessity for binding it or injuring the insulation in any way. This results in a saving of both material and labor and reduces the cost of installation.



Insulator for Interior Work.

The new insulator is made by the Porak-Isolatoren-Unternehmung, Wiedener Gurtel 28, Vienna, Austria, by whom applications for patents have been made in all civilized countries.

A New Shop-Lighting Unit.

To meet factory conditions, the Delta-Star Electric Company, Chicago, Ill., has developed the single-unit "Instolite" illustrated herewith, consisting of a porcelain-enameled steel shade, complete with keyless socket and

Shop-Lighting Unit.

stranded rubber-covered wires ready for connection to the ceiling wires.

Instolite fixtures are so designed as to be concentrating or distributing as desired, depending upon the wattage of the lamp used in each particular reflector. For example, with a 40-watt lamp, the relation of the filament to the reflector is such that it is concentrating and with a 60-watt lamp the reflector is distributing. In designing the reflector, care has been taken to avoid slots or holes in the steel, thus eliminating edges from which the enamel will break off, exposing the steel to atmospheric action, acid fumes, etc. This new line of single units will be found of service in securing the best possible bench, tool or machine lighting at minimum expense.

Extending Telephone Lines.

The Chicago, Burlington and Quincy Railway Company recently placed an order with the Western Electric Company for apparatus to be used in extending its telephone train-dispatching circuits. The successful operation of the present lines and the economy resulting therefrom has been the incentive for the extension.

At present, there is a train wire, operated by special selector sets of Western Electric manufacture, from Kansas City to Napier, Mo., with the train dispatcher at St. Joseph, thus working the circuit from St. Joseph to Kansas City on one end and from St. Joseph to Napier on the other. The extension will bring the train wire into Council Bluffs, Iowa, from Napier. This branch is now operated by telegraph and it will be simpler to operate the entire line by telephone, than by using a combination.

Fourteen special selector sets will be installed in way stations along the line to Council Bluffs. The dispatchers will be located at St. Joseph. The new line is aproximately 95 miles long.

Sterling Incandescent Lamp Conference.

The executive department and selling organization of the Sterling Electric Works of the General Electric Company, under the direction of William Coale, manager, held its annual conference and salesmen's meeting about five miles from Warren, O., at a camp on the banks of the Mahoning River, the week of August 5. The business outlook was discussed and satisfactory reports received from various sections of the country. The campers thoroughly enjoyed every session, and a good deal of time was devoted to recreation and entertainment. During the serious sessions addresses were made by Messrs. Bauder, Boynton, Brittin, Presbrey and McKittrick, of the engineering and publicity departments of the National Electric Lamp Association.

New General Electric Laboratory.

According to an official of the General Electric Company, the company has plans under way calling for the expenditure of about $1,000,000 on improvements. These include the erection of a metal research laboratory, to cost about $200,000.

Heine Method of Superheating.

The advantages of using superheated steam are generally well recognized. Certain definite savings in steam consumption result from heating steam above the temperature corresponding to the pressure and as this saving in steam consumption is derived from only a small increase in fuel consumption, a substantial net fuel saving is secured.

The per cent decrease in the turbine water rate due to the use of superheated steam is as follows: 50 degrees superheat, 5 per cent; 100 degrees superheat, 10 per cent; 150 degrees superheat, 14 per cent. This improvement in steam consumption and turbine efficiency, due to the use of superheat, is compared to the efficiency and steam consumption with dry saturated steam. Ordinarily, however, steam supposedly dry, will contain a small amount of moisture which causes a reduction in efficiency.

The saving in coal consumption, due to the use of superheated steam, is not as large as the percentage saving in steam consumption. 100 degrees superheat will reduce the steam consumption of a turbine, say, 10 per cent. This means that instead of one pound of water evaporated under dry and saturated conditions, only 9/10 of a pound of water need be required if the steam be superheated 100 degrees. Assuming the feed temperature as 200 degrees, the heat absorbed in the boiler for one pound of steam at 150 pounds gauge without superheat is 1,027 British thermal units. The heat in 0.9 pound of steam under the same conditions is 924.3 British thermal units, the difference, 102.7 units, being saved.

If by using superheated steam, 10 or 15 per cent of the output of a plant may be generated for just half the cost of the remainder of the output, it is of great importance that the superheat for which the turbine or engines are best adapted be determined by trials and then maintained continuously. The temperature of the steam should not be allowed to fall below the mean, since economy is sacrificed, and on the other hand the temperature should not be allowed to exceed the predetermined mean, as troubles with valves, fittings and cast parts are liable to arise.

When the economy of superheating was first realized, superheats as high as 300 degrees were sometimes specified, and superheaters of a good many square feet of surface installed. It was found, however, that steam at these very high temperatures gave a great deal of trouble and caused rupture of cast-iron valves and fittings. By substituting high-grade cast steel, high superheats could be carried, but the added cost for these improved fittings tended to counterbalance the added returns from the use of higher steam temperatures. As a result, it has been found that the highest commercial efficiency, everything considered, is secured by the use of moderate superheat, and it has now become quite general practice to run at 125 to 150 degrees Fahrenheit in turbine plants, and the same or somewhat lower superheat in reciprocating-engine plants, where a low superheat eliminates losses from moisture and reduces cylinder condensation without causing lubricating troubles.

The temperature to which steam will be superheated depends upon the amount of steam flowing through the superheater tubes and its temperature, and secondly upon the amount of gas flowing over the tubes and its temperature. As the quantity of steam is controlled by the boiler load, the temperature of steam will be determined by the amount and temperature of the hot gases, which will in turn depend on the design and arrangement of boiler and superheater.

There are a number of methods of installing superheaters. First we may consider that in which the superheater is placed in the path of the combustion gases after they have passed over a part of the boiler-tube surface. As the first pass in the boiler absorbs as much as 80 per cent of the heat in the gases, their temperature when passing over the superheater surface is comparatively low and hence the superheater surface must be quite large. It is difficult to obtain adjustment or close regulation of superheat with this arrangement. If the volume of combustion gases and their temperature varied always in exact accordance with the amount of steam generated and passing through the superheater, the degree of superheat would be practically constant. But the amount of air used to burn a pound of coal, the temperature of the fire and therefore the temperature of the gases after they have passed over part of the boiler surface and come in contact with the superheater surface, vary even with constant boiler load, and since the load varies with boiler pressure and the demand for steam, there are likely to be wide fluctuations in steam temperature when a superheater is installed in this manner.

Superheaters are also installed in the path of combustion gases before entering the fire tubes of a return tubular boiler, but here again the same reasons apply to explain why constant or adjustable superheat is not obtained.

It has been found, therefore, that in order to secure constant superheat, it is necessary to control the volume of gases which pass over the superheater surface. A recent method is described in a paper read before the Institution of Naval Architects, March 28, 1912, by Harold E. Yarrow. Here part of the boiler surface on one side of the Yarrow boiler is replaced by superheater surface, and the combustion gases rising from the fuel bed in the center are divided between the boiler surface on one side and the boiler and superheater on the other.

Another method of installing a superheater is illustrated by the Heine superheater. The superheater itself consists of a header box into one side of which are inserted U-tubes made of 1.5-inch seamless drawn mild-steel tubing, expanded into holes provided for them. Hollow staybolts are used in the header and provide means for introducing a soot blower in order to keep the exterior surfaces of the superheater tube free from soot. The header box is divided into three compartments, so that the steam makes four passes in passing through the tube surface.

The superheater is located at the side of the shell towards the front of the boiler and a small flue built in the side walls of the setting carries hot gas from the furnace into the superheater chamber. The gases passing up this flue come in contact with only a small part of the boiler surface and then enter the superheater chamber, making two passes over the superheater surface. According to a number of experiments the temperature of the gases entering the superheater is about 1,500 degrees Fahrenheit. The average gas temperature is thus about 1,000 degrees Fahrenheit and with an average steam temperature of 425 degrees the difference in temperature is 575 degrees. With superheaters installed in the path of the boiler gas, the average gas temperature is in the neighborhood of 700 or 800 degrees and the difference in temperature determining the rate of heat transmission is 275 to 375 degrees.

In several respects this design is similar to an independently fired superheater. But with the latter type, control of the steam temperature can only be secured by control of combustion. The steam supply to the superheater must never fall off, or else the tubes will be overheated before combustion can be checked and the furnace cooled.

By installing the superheater as indicated, a damper in the outlet of the superheater setting controls the volume of hot gases used, and can shut off the flow of combustion gases entirely, when no superheat is desired or when the load goes off.

The Heine superheater is made by the Heine Safety Boiler Company, St. Louis, Mo.

Current Electrical News

LIGHTING AND POWER.

(Special Correspondence.)

STORM LAKE, IOWA.—An ornamental lighting system will be installed at this place. C.

VALLEY CITY, N. D.—The Council has voted to install an ornamental lighting system. C.

MINNEOTA, MINN.—A franchise has been granted to the Canby Electric Light Company. C.

HIBBING, MINN.—The water and Light Commission will install a "White Way" in Hibbing. C.

ST. PETER, MINN.—An ornamental lighting system will be installed on Minnesota Avenue. C.

WILMINGTON, DEL.—Better illumination of certain streets of this city is being considered.

MUSCATINE, IOWA.—A franchise has been granted to the Citizens' Railway & Light Company. C.

FOXHOME, MINN.—It has been decided by the citizens to install electric lights at this place. C.

OGDEN, IOWA.—A 20-year franchise has been granted to the Central Light & Power Company. C.

ALDERTON, WASH.—This city has under consideration the installation of an electric lighting system.

RHODES, IDAHO.—This city has under consideration the installation of an electric lighting system.

FORT MADISON, IOWA.—A 25-year franchise has been granted to the Mississippi Power Company. C.

ROLFE, IOWA.—An electric light franchise has been granted to the Humboldt Electric Light Company. C.

DELTA, IOWA.—An electric light franchise has been granted to the Sigourney Transmission Company. C.

BELLE PLAINE, MINN.—The Commercial Club has started a movement for electric lights for this place.

SHELDON, MO.—This town is preparing to install a municipal electric light plant.

HILLS, MINN.—It is reported that this city is considering the advisability of installing an electric lighting system.

NEW LONDON, IOWA.—The election to issue bonds for a municipal light plant has been carried by a large majority.

SACRAMENTO, CAL.—A complete electrolier lighting system is the aim of the residents and City Council of Sacramento.

NORTH LIBERTY, IOWA.—An electric light franchise has been granted to the Iowa City & Cedar Rapids Light Company. C.

DULUTH, MINN.—The West End Hillside Improvement Society has started a movement for street lights in the Seventh Ward. C.

ROCHESTER, N. Y.—The Defender Photo Supply Company has been granted a permit to erect a power plant in connection with its new factory.

LUVERNE, MINN.—A bond issue of $10,000 has been favorably voted upon by the citizens of Luverne for improvements to the electric lighting plant.

ALHAMBRA, CAL.—An ordinance has been adopted providing for a street lighting system which will form a part of the boulevard from this city to Los Angeles.

DOWAGIAC, MICH.—Electric Light Commissioner Reynolds has been given instruction by the Council to get figures on a generator for commercial lighting purposes.

PLATTSBURG, N. Y.—The Champlain Paper Company and the Progressive Company are debating the advisability of erecting a power plant on their property at this place.

SEATTLE, WASH.—Richmond Highlands Light & Water Company has been incorporated with a capital stock of $2,500 by William D. Perkins, R. S. Bloss and others.

KENTON, O.—The Hardin-Wyandot Lighting Company will install in its new building three 500-horsepower boilers and new electrical machinery, which will be of the latest type.

SUMPTER, ORE.—The Northwestern Light & Power Company will at once rebuild its electric lighting plant, which was recently destroyed by fire, causing a loss of $10,000.

ROGERS, TEX.—This town is considering the proposition from Temple to raise a bonus of $1,000 and have high-tension wires stretched from the power house there to Rogers.

THE DALLES, ORE.—Construction work will be started soon by the Pacific Power & Light Company on a new transmission line between this city and its power plant at White River Falls.

ALPINE, TEX.—The Alpine Power Company has been organized and will install additional machinery in its electric light and power plant here. It will also increase the capacity of its ice factory. D.

COHOES, N. Y.—Walter H. Wertime, Cohoes attorney, is urging the Common Council to establish a city lighting and power plant, believing that this would be a great economy to the taxpayers.

WALLACE, IDAHO.—The Kootenai Power & Construction Company has filed articles of incorporation with a capital stock of $600,000. The incorporators are E. E. McWhitney, W. J. Maloney and Norman B. Coffin, all of Wilmington, Del.

WEST SALEM, WIS.—The Railroad Commission has ordered that the public lighting system of this place must be improved within six months or it will issue a certificate of public convenience and necessity for the erection of a new plant.

FLORESVILLE, TEX.—C. F. Spencer and associates of San Antonio have been granted a franchise to put in an electric light plant in this city, and have placed before the City Council a proposition to furnish power for the city waterworks plant.

LITTLE FALLS, MINN.—The Pike Rapids Hydro-Electric Company has filed articles of incorporation with the Secretary of State for the purpose of putting in a dam at Pike Rapids, near this place. John L. McCauge, of Omaha, is the moving spirit of the enterprise.

SPRINGFIELD, O.—Councilman Dan Sadlier is in charge of the preparation of an ordinance to be submitted to the people of this place on November 5 for the construction of a municipal lighting plant. It is proposed to issue bonds in the amount of $600,000 for the purpose.

ALBANY, N. Y.—The Santa Clara Light & Power Company has filed articles of incorporation with a capital stock of $800,000 for the purpose of operating outside of New York State. The directors are S. J. Bischoff, Peter J. Brancato and David C. Broderick, all of Brooklyn.

SAN FRANCISCO, CAL.—The Indian Valley Electric Light & Power Company has filed an amended application to issue 100,000 shares of common stock and $250,000 in bonds for the purpose of additional construction, and also to issue promissory notes to the amount of $50,000.

FRANKFORT, MICH.—The Benzie County Power Company has been incorporated with a capital stock of $75,000 by Eugene Zimmerman of Cincinnati, O. Building of the first dam, which will produce 600 horsepower, will commence at once and two other dams will be built later.

ELDORA, IOWA.—The mill site, water rights and five acres of land at Eagle City have been bought by E. H. Lundy, purchaser of the Union Electric Light plant. The Iowa Falls dam property also was sold recently and electric lights and many extensions of electric service lines are expected.

PARKERSBURG, W. VA.—The Charleston-Parkersburg Electric Juice Company has been incorporated with a capital stock of $500,000 for the purpose of manufacturing electricity. The incorporators are Albert E. Boone, George Pfalzgraf, I. M. Agey, Margaret E. Barnes and A. G. Wile, all of this place.

OROVILLE, CAL.—The Oro Electric Corporation has a force of men employed in the Hamburg Valley, where it is to build a 10,000,000 power plant next year. A tramway, which is to be operated by electricity, is to be

built from the power site up Yellow Creek to the place where the dam will be located.

FOSTORIA, O.—The Ohio Light & Power Company, purchaser of the interests of the Standard Light & Power Company, owners of the electric lighting plant in this city, will assume control of the plant about September 1 and it is probable that a large amount of money will be expended on additions and improvements. H.

WINCHESTER, IND.—The Citizens' Heat, Light & Power Company has been incorporated with a capital stock of $400,000. The directors are J. T. Moorman, E. F. Kitselman, E. S. Goodrich, G. E. Leggett, W. E. Miller and C. W. Moore. The purpose of the company is to extend the scope of the Citizens' Light & Water Company.

WINNIPEG, MAN.—The McKenzie and Mann interests, represented by the Winnipeg Electric Company, have in progress a big scheme for generating electric power at Bonnet Falls, north of Fort Alexander, for the operation of a terminal traffic here and for the construction of a car line to the Eastern shore of Lake Winnipeg.

MARBLE FALLS, TEX.—The unfinished reinforced-concrete dam across the Colorado River at this place and other holdings of the Colorado River Power Company have been sold to the St. Louis Title Trust Company, which held a mortgage upon the property. It is stated that the purchasing company will complete the dam and install a large hydroelectric plant.

DONALDSONVILLE, LA.—A committee composed of John S. Thibaut, E. K. Sims, Alexander Bloomenstiel, F. B. Lemann and Adolphe Netter, has been appointed by the City Council to finance the proposed improvements to the equipment of the municipal power plant and to assume entire management and control until the cost of these improvements has been liquidated and the electric light system placed on a money-making basis. It is expected that the cost of these improvements will be about $40,000, and that the necessary funds will be supplied by local capital.

WICHITA FALLS, TEX.—An electric power development and transmission enterprise of much magnitude is on foot here. As a preliminary step to carrying out the plans for the project the Wichita Falls Electric Company has been organized with a capital stock of $700,000 and has taken over the property, franchise and contracts of the Wichita Falls Water & Light Company. The new corporation proposes to generate electric power and not only supply Wichita Falls with the energy but to transmit it to other towns of this section. The incorporators are D. G. Fisher, W. H. Painter, P. B. Crueger, Frank Smith and C. Hunn, of Dallas, and W. H. Schweikhardt. Another corporation known as the Wichita Falls Water Company has been organized with a capital stock of $400,000 to take over the waterworks plant and distributing system which formed a part of the holdings of the Wichita Falls Water & Light Company. This new company will enlarge and improve the waterworks system of the town. The incorporators are J. D. Caldwell, H. I. Gahagan, Walter Graner, J. R. Wolfe, W. T. Koch and A. G. Stockton, all of Dallas. D.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

ENTERPRISE, FLA.—Enterprise Telephone Company has been incorporated with Fred A. Gordon, president.

WATTS, CAL.—Bids will be received up to September 17 for a 21-year franchise to operate a telephone and telegraph system in this town.

MILLADORE, WIS.—The Milladore Telephone Company has been incorporated with a capital stock of $4,000. The incorporators are J. Verhulst, J. E. Malik and J. W. Cheney.

FAIRVIEW, S. D.—Carl Dyvig, of Inwood, has bought a controlling interest in the local telephone system. A direct line will be built to Inwood and the local system improved. C.

OKLAHOMA CITY, OKLA.—An Oklahoma charter has been issued to the Davis Rural Telephone Company, of Davis, Murray County, which has a capital stock of $1,000. The incorporators are Charles Hutchins, J. F. Ellis and W. M. Baughman. P.

BOWLING GREEN, O.—A new Farmers' Mutual Telephone Company has been organized here and will at once begin work upon the completion of a modern local plant. Elias Miller was chosen president and T. A. Rosendale secretary of the new concern. H.

LOS ANGELES, CAL.—The American Telegraph Company will have to obtain a franchise and pay two per cent of its gross earnings to the city each year for the privilege of doing business in the city, and will have to remove its wires from poles and place them in conduits.

UPPER SANDUSKY, O.—An issue of stock to the amount of $45,000 has been allowed by the State Public Service Commission to the Sycamore Telephone Company, of this county. The new company will take over the plant owned by George A. Klahr and other members of the Klahr family. H.

LOUISVILLE, KY.—The contract which has been in existence between the Louisville & Nashville Railroad Company and the Western Union Telegraph Company has been terminated and the railway company is now preparing to install its own telegraph system. G.

NEW YORK, N. Y.—Articles of incorporation have been granted to the Haiti Port Railways, Light & Power Company, having a capital stock of $5,000,000. The incorporators of the company are John A. Chrystie, New York City; Frank J. Torpey, Brooklyn, and Charles Sternheim, Fernwood, N. J. The object of the company is to build warehouses and operate telephone and telegraph lines in Haiti.

LOUISVILLE, KY.—The Postal Telegraph Cable Company has filed amended articles of incorporation empowering it to own and operate telephone as well as telegraph lines. It is stated that the company is building a telephone line from Maysville to Huntington, W. Va., which has made the change necessary. It is also suggested that the development of the company's business in the West has been largely along the line of telephone operation, and it is believed that the change which has been made signifies still further extensions of this branch of its system. G.

ELECTRIC RAILWAYS.

(Special Correspondence.)

WATSONVILLE, CAL.—Plans are being made for the extension of the Watsonville Railway & Navigation Company's line into the San Joaquin Valley and to San Francisco Bay.

PORTLAND, ORE.—East Tillamook Street Improvement Club is supporting the extension of the street car line along Tillamook Street from Sandy Road to East Nineteenth Street.

PORTLAND, ORE.—The residents of Brentwood, adjoining Errol Heights, are forming an association to support the plan of extending the car line from its present terminus through Errol Heights.

JAMESTOWN, N. Y.—There is a movement on foot for the establishment of a trolley line between Hamburg and Falconer, thus connecting Jamestown and Buffalo by trolley. Nothing definite is known of the plans.

SALINA, KANS.—This town is at the present time engaged in raising $50,000 for the Salina, Tipton & Northern Railroad Company, which will build an interurban from Osborne to Salina. The road is to be completed by 1914.

NEWBURY, PA.—James K. Mosser, Jr., is chairman of a committee which has in hand the extension of the West Third trolley line. Residents of Newbury are much interested in the construction of this loop as it would mean much to that portion of the city.

PASADENA, CAL.—The directors of the Pasadena Board of Trade have heartily endorsed the proposition of the Pacific Electric Company to build a car line on Lincoln Avenue, believing that it is the first link in a line which will ultimately be built to the La Canyada Valley.

CENTRAL CITY, KY.—J. A. Rose is completing arrangements for the construction of a traction line between this city and Greenville. A power house will be built near Dovey and arrangements will be made to furnish current for the operation of a number of coal mines in the Central City district. G.

OLYMPIA, WASH.—It is reported that the Washington & Oregon Corporation, of which Isaac W. Anderson is president, will extend the Chehalis-Centralia interurban line from the Centralia terminus, by way of Tenino, to the Southern terminus of the Olympia Light & Power Company tracks in Tumwater.

PADUCAH, KY.—The Kentucky Southwestern Electric Railway, Light & Power Company announces the completion of its surveys and the acquirement of the necessary rights of way for the construction of its traction line from Paducah to Mayfield. W. A. Calhoun, of Buffalo, N. Y., is consulting engineer. G.

RUSHVILLE, ILL.—E. L. Tobie is the promoter of an interurban railroad which will run through Rushville if present plans are consummated, which are to build an interurban railroad from Macomb to Stronghurst, a distance of 25 miles. There is much interest in the project and steps are being taken to have the road built this way.

LITTLE ROCK, ARK.—The Mount Ida, Ouachita Valley and Hot Springs Railway Company has been incorporated with a capital stock of $80,000.

The directors are G. H. Spear, L. L. Beavers, S. T. Smith, C. J. Watkins and others. The company will build a road from a point on the Gurdon and Fort Smith Road to Caddo Gap, to Mount Ida, a distance of eight miles.

OGDEN, UTAH.—It has been decided to grant a franchise for the construction of the Utah County Interurban Road. The plans call for an interurban to be built to Payson and it is expected that it will later be extended to Nephi, in Juab County. Among those interested in the project are Abel John Evans of Nehi, George Whitmore of Nephi, and W. W. Armstrong.

BARTLESVILLE, OKLA.—The majority of the stock of the Bartlesville Interurban Railway Company has been transferred to an eastern syndicate, and it is announced that the Bartlesville-Dewey line will be extended north to Caney, Kans., and will make connections with the lines connecting Iola, Chanute, Cherryvale, Independence, Coffeyville and other Southern Kansas towns. P.

WASHINGTON, D. C.—A new company, whose incorporators include Herbert F. L. Allen, Joseph A. Burkhart, Horace H. Lurton, Jr., Charles H. Ridenour, Charles A. Breckons, has been formed for the purpose of building a subway from the Union Station to the Capitol grounds and thence down Pennsylvania Avenue to the Treasury, where the tracks will become surface lines and run to Thomas Circle.

FRANKFORT, KY—The Shelbyville & Frankfort Realty Company, which was recently incorporated for the purpose of acquiring rights of way for a traction line from Frankfort to Shelbyville has made arrangements with New York interests to finance the line, the construction of which will cost $330,000. Half of this amount will be raised in Frankfort. E. H. Taylor, Jr., is president of the company. G.

TULSA, OKLA.—President Charles Page, of the Tulsa & Sand Springs Railway Company, announces that a deal has been definitely closed for the extension of that line to Oologah, by way of Collinsville, a distance of 30 miles. Both towns are in the oil belt and also in a good farming district, which is thickly settled, and expectations are that the line will be a revenue-producing proposition from the start. P.

OKLAHOMA CITY, OKLA.—Considerable interest is felt in the report that a line is to be constructed from Sapulpa to Fort Scott, Kans., by the Oklahoma Public Service & Interurban Lines Company, as a link in an interurban system from Kansas City to Oklahoma City. The right of way has practically all been secured by the Kansas City-Fort Scott Interurban Railway Company, which is to build the northern end of the line, and the plan is said to be to come on into Oklahoma City from Sapulpa over the tracks of the Frisco Railroad. P.

SEATTLE, WASH.—Articles of incorporation have been filed by the Seattle-Tacoma-Olympia Railway Company with a capital stock of $1,500,000. The trustees and those named to have charge of the company's business are W. D. Hall, J. S. Wheeler and S. L. Cravens. The purpose of the company is to build an interurban road touching the three places named and it may be operated by electrical power, compressed air, any mechanical power or steam or animal power, and the company may buy, sell, lease or otherwise acquire real estate, power stations, passenger depots, freight stations, tracks, viaducts, bridges, power and electrical circuits and may do a general business in lighting and heating as well as transportation.

FINANCIAL NOTES.

In financial circles, at the large centers at least, securities have improved in activity but from a speculative and investment viewpoint. The copper market has attracted attention. It is expected that the next outburst of buying abroad will carry the metal to 18 cents a pound. Reports from every section indicate a spirit of great optimism, and already the electrical manufacturing companies have felt something of real stimulus in the volume and value of orders received.

A deal has been closed with the Middle West Utilities Company, of which Samuel Insull of Chicago is president, for the sale of 90 per cent of the stock in the Shelbyville Water & Light Company, at $150 a share, the purchaser assuming the bonded debt of $40,000. The shareholders will pay the floating indebtedness, which will make the stock net them about $140. Possession of the plant will be given Sept. 1.

The capital stock of the company is $26,000. The plant was built in 1894 at a first cost of $40,000; since then a like amount has been expended in improvements. About 90 per cent of the stock was held by J. C. Bright, S. M. Long, L. C. Willis, John K. Todd and George S. Chowning.

The Montpelier Electric Light Company has been sold at sheriff's sale to the Citizens Trust Company, of Ft. Wayne, Ind., for $55,000. The Fort Wayne concern is trustee of the original bondholders. The purchaser will continue to operate the plant until its ultimate disposition.

Much interest has been shown in the Kentucky Utilities Company, which has filed articles of incorporation in Louisville, giving its capital stock as $2,000,000. The incorporators, all residents of Chicago, are William R. Watson, Charles J. Ruebling and L. Earle Powell. The charter of the company gives it wide scope, including the manufacture and sale of electricity for light, heat and power purposes; the maintenance and operation of subways; the manufacture and sale of artificial gas; the mining and distribution of natural gas; dealing in stoves, engines, motors, petroleum, etc.; selling and dealing in ice and the maintenance of cold storage plants; acquiring and maintaining hydro-electric plants; constructing, owning and acquiring street and interurban traction lines; operating and maintaining water-works; operating telephone and telegraph lines, etc.

The annual meeting of the Philadelphia Rapid Transit Company will be held September 18.

The Philadelphia Traction Company, leased to the Union Traction Company, has called for payment at 105 and interest on August 15 of $32,000 of its collateral-trust four-per-cent bonds, due 1917, part of an outstanding issue of $338,000.

A mortgage has been filed by the Adirondack Electric Power Corporation in Rensselaer County, N. Y., to cover an issue of $10,000,000 bonds, of which $5,000,000 have been authorized for sale by the New York Public Service Commission.

The Canadian Light & Power Company of Montreal, will increase its capital stock from $6,000,000 to $7,000,000. The company owns and operates a hydroelectric plant not far from Montreal on the St. Lawrence River. The increase is a part of the plan to further develop the plant, which at first developed only 20,000 horsepower. It is said that after these improvements have been established the average horsepower development will reach 100,000.

Dividends.

American Telegraph & Cable Company, the regular quarterly dividend of 1.25 per cent, payable September 3 to stock of record August 31.

Blackstone Valley Gas & Electric Company, quarterly dividends of $1.50 a share on the preferred stock and $2 a share on the common stock, payable September 3 to stock of record August 16.

Columbus Railway Company, quarterly common dividend of 1.25 per cent, payable September 2 to stock of record August 15.

Eastern Pennsylvania Power Company; a quarterly preferred dividend of 1.75 per cent, payable August 15 to stock of record July 31.

General Electric Company, a regular quarterly dividend of two per cent, payable October 15 to stock of record September 7.

Philadelphia Electric Company; the regular quarterly dividend of 1.5 per cent on the common stock, payable September 2 to stock of record Auly 100,000.

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	Aug. 19.	Aug. 12.
Allis-Chalmers common (New York)	1⅛	*1⅛
Allis-Chalmers preferred (New York)	5¼	4½
American Tel. & Tel. (New York)	145⅝	145⅞
Commonwealth Edison (Chicago)	139	139
Edison Electric Illuminating (Boston)	289½	290
Electric Company of America (Philadelphia)	*12¼	*12¼
Electric Storage Battery common (Philadelphia)	57⅜	56
Electric Storage Battery preferred (Philadelphia)	57¾	56
General Electric (New York)	182	182⅝
Kings County Electric (New York)	129	129
Manhattan Transit (New York)	2¼	2⅜
Massachusetts Electric common (Boston)	19	18½
Massachusetts Electric preferred (Boston)	*94	94
National Carbon common (Chicago)	120	122
National Carbon preferred (Chicago)	118	118
New England Telephone (Boston)	153	152
Philadelphia Electric (Philadelphia)	24	23⅝
Postal Telegraph and Cables common (New York)	87	85
Postal Telegraph and Cables preferred (New York)	69	69¼
Western Union (New York)	83	81¾
Westinghouse common (New York)	86¼	88¼
Westinghouse preferred (New York)	123⅛	123⅛

*Last price quoted.

PERSONAL MENTION.

F. S. TERRY, the well known manufacturer of incandescent lamps, sailed for Europe on August 22 from New York, on the new French steamer *France*. Mr. Terry will be abroad for several weeks.

G. S. MERRILL, associate engineer, Engineering Department, National Electric Lamp Association, read a paper on "Electric Rates" before the convention of the Georgia Section of the National Electric Light Association at Tybee, Ga., August 15.

GEORGE T. MANSON, general superintendent of the Okonite Company, New York City, has been ill for several weeks and recently underwent a severe surgical operation. His many friends will be glad to know that he is now convalescent and about to resume his activities in the field.

W. D'A. RYAN, illuminating engineer for the General Electric Company at Schenectady, lectured before the local electrical men of San Francisco on the evening of August 16. The lecture was delivered in the Colonial Ball Room of the St. Francis Hotel. Mr. Ryan took The History of Illumination for his subject, and he was heard by a large and representative audience.

R. E. LUCAS, president and general manager of the Marion Insulated Wire & Rubber Company, Marion, Ind., recently returned from a trip to the Pacific Coast. While out West Mr. Lucas opened branch offices in San Francisco and Los Angeles. These offices, with the Seattle office, which the company has had for some time, puts it in excellent position to take care of its western business.

A. LARNEY, formerly manager of the new business department of the Consumers Power Company, St. Paul, Minn., has been transferred by H. M. Byllesby and Company to Minneapolis, Minn., as sales manager for the Minneapolis General Electric Company, succeeding H. J. Gille, who was formerly sales manager for the Stone & Webster Company prior to the transfer of this property to the Byllesby interests recently.

SIDNEY L. COLE, Fort Madison, Iowa, has accepted the offer of the Wakefield (Mass.) Light Board and will become manager of the municipal gas and electric plants in that town. Mr. Cole is a native of Somerville and a graduate of the Massachusetts Institute of Technology, and has had experience in various official capacities in Niagara Falls, Philadelphia, Waukegan, Ill., Little Rock, Ark., and Fort Madison, Iowa.

KARL GEORG FRANK, American representative of the Siemens & Halske Company, was a visitor to Chicago last week. Dr. Frank has recently returned from a trip abroad and was on his way to Kansas City and St. Louis and other points in the west. Dr. Frank reports that business in Germany in electrical lines, especially in measuring instruments and small apparatus, is particularly good, several of the factories being unable to take further orders at this time. Business in this country he finds is materially improving, and his company's share in the demand for physical and laboratory apparatus, flaming-arc carbons and other apparatus of a similar nature is very satisfactory.

H. CAIRD has been appointed assistant district superintendent at Belvidere, Ill., of the plant of the Northern Illinois Utilities Company. Mr. Caird has been connected with the industry since 1901, when he was employed with the General Electric Company, at Lynn, Mass. He was there until 1904, when he became connected with the Cheboygan Electric Light & Power Company, Cheboygan, Mich., where he remained for eight months, installing a new arc system and transmission line. From 1905 to 1908 he was superintendent of construction and maintenance of the Macon (Ga.) Railway & Lighting Company. Since 1908, Mr. Caird has been connected with the manufacturing and selling end, being associated as sales engineer, 1908-1909, with the Central Electric Company, Chicago, and since 1909 in the flaming arc business with the Excello Arc Lamp Company and Koerting & Mathiesen.

OBITUARY.

THOMAS H. BRADY, president of the Brady Electric Manufacturing Company, New Britain, Conn., died at his summer home at Westbrook, Conn., on August 17. Mr. Brady had been ill for some time. He was one of the real old-timers in the electrical industry. He had served as alderman of New Britain when the city was established in 1871, and was for four terms a member of the Connecticut Legislature. He had also been a member of various civic and community commissions. Mr. Brady is survived by a wife and 10 children.

NEW PUBLICATIONS.

MUNICIPAL SCHOOL OF TECHNOLOGY.—Vol. V of the *Journal of the Municipal School of Technology*, Manchester, England, has come from the press. Among numerous other articles the following may be noted: "Electricity Meters With Notes on Meter Testing," by H. A. Ratcliff and A. E. Moore; "The Electrical Theory of Dyeing," by W. Harrison; "Modern Sewage Disposal," by E. L. Leeming.

FOREIGN TRADE OPPORTUNITIES.

(*Parties interested in the following items should address the Bureau of Manufactures, Washington, D. C., and refer to the file number noted.*)

NO. 9342. ELECTRICAL GOODS.—A firm in New York advises the Bureau of Manufactures that it is in receipt of a communication from a business house in Argentina which desires to represent a reliable factory in the United States manufacturing electrical fittings such as lamp holders, switches, etc.

NO. 9351. ELECTRIC COFFEE ROASTERS.—A report from an American consular officer in South Africa states that a merchant in his district wishes to get in touch with manufacturers of electric coffee roasters in the United States. The consul adds that small and medium capacity machines are likely to be in demand, and that duplicate catalogues and price lists be sent to the consulate.

PROPOSALS.

TRANSFORMERS.—Sealed proposals will be received until September 10 by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing 29 single-phase, 60-cycle, oil-cooled transformers, as per Class 131, Pearl Harbor.

ELECTRIC WIRING AND CONDUIT AND LIGHTING FIXTURES.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until September 18 for electric wiring and conduits and lighting fixtures of a two-story building for the post office at Livingston, Mont., until September 23 of a one-story building for the post office at Johnstown, N. Y.; until October 14 of a two-story building for the post office at Oldtown, Me. Drawings and specifications may be obtained from the custodian of the various sites or from the office of the Supervising Architect.

NEW INCORPORATIONS.

CHATTANOOGA, TENN.—The Chastteen Signal System Company has been incorporated with $200,000 capital stock and will manufacture a railway-signaling device. W. J. Chastteen, of East Chattanooga, is president of the company. G.

NEW YORK, N. Y.—Electric Spark Appliance Company has been incorporated with a capital stock of $5,000 for the purpose of manufacturing electrical devices for automobiles. The incorporators are Michael M. Lint, Peter Ross and Alexander Miller, all of New York City.

LOUISVILLE, KY.—Articles of incorporation have been filed by the Kentucky Utilities Company with a capital stock of $2,000,000. The incorporators are W. R. Watson, Charles J. Ruebling and L. Earle Powell, of Chicago. The purpose of the company is the manufacture and sale of light, heat and power and the operation of street and interurban railways.

WHITNEY, N. C.—The Southern Aluminum Company, which was recently organized with a capital stock of $8,000,000, has let two contracts of $600,000 each, preparatory to the development of the large power plant on the Yadkin River. The first is to J. H. Sands, of Roanoke, Va., for the completion of the four-mile canal, and the second to H. B. Hardaway, of Columbus, Ga., for the completion of the dam. The Southern Aluminum Company has completed negotiations whereby it has come into possession of the unfinished hydroelectric development of the Whitney Company, which had spent about a million dollars on the project, the sale including the uncompleted hydroelectric development and 2,000 acres of land, the granite quarries, gold mines, timber land, etc., the intention being later development and establishment of a town.

DATES AHEAD.

International Association of Municipal Electricians. Annual convention, Peoria, Ill., August 26-30.

American Electrotherapeutic Association. Richmond, Va., September 3-4.

International Association for Testing Materials, Sixth congress, New York City, September 3-7.

Pennsylvania Electric Association. Annual convention, Bedford Springs Hotel, Bedford Springs, Pa., September 4-6.

Eighth International Congress of Applied Chemistry. Washington, D. C., September 4, New York, N. Y., September 6-13.

American Electrochemical Society. Fall meeting in conjunction with Electrochemical Section of International Congress, New York. N. Y., September 7, 9 and 10.

Association of Edison Illuminating Companies. Annual convention, Hot Springs, Va., September 10-12.

Illuminating Engineering Society. Annual convention, Hotel Clifton, Niagara Falls, Ont., September 16-19.

Association of Iron and Steel Electrical Engineers. Annual convention, Hotel Pfister, Milwaukee, Wis., September 23-28.

The 1912 Boston Electric Show, Mechanics' Building, Boston, Mass., September 28-October 26.

American Electric Railway Association and its five affiliated associations. Annual convention, Chicago, Ill., October 7-11.

The New York Electrical Exposition and Automobile Show. The New Grand Central Palace, New York City, October 9-19.

Electric Vehicle Association. Annual convention, Boston, Mass., October 8.

New England Section of the National Electric Light Association. Fall meeting, Boston, Mass., October 10 and 11.

Sons of Jove. Annual convention, Pittsburgh, Pa., October 14-16.

Kansas Gas, Water, Electric Light and Street Railway Association. Annual meeting, Manhattan, Kans. October 17-19.

With the Electrical Manufacturers

The Marion Insulated Wire & Rubber Company, Marion, Ind., recently secured a very substantial order from the Government for its "Eagle Brand" rubber-covered wire, for use at the Panama Canal. The company also made a shipment of duplex telephone wire to Honolulu recently for use in the telephone exchange there.

The United Electric Company, Canton, O., is distributing a very useful little booklet entitled "Vacuum Cleaning." This gives tables on velocity, vacuum loss and other data that are found of great value to architects, engineers and contractors. Copies of this booklet will be sent to those interested in vacuum cleaning problems.

Pass & Seymour, Incorporated, Solvay, N. Y., is distributing its new catalog No. 20. This catalog is particularly complete, especially with reference to the new line of Shurlok sockets and the line of outlet-box receptacles and rosettes. An outlet-box receptacle or an outlet-box rosette has been provided to meet practically any condition that might arise. Copies of this catalog will be sent upon request.

The Morris Iron Company, Frederick, Md., has issued in loose-leaf form a series of data sheets illustrating and describing, with list prices, a number of designs for ornamental street-lighting standards. These data will be sent to business and civic organizations, contractors of municipal lighting plants, purchasing agents of central stations, and anyone interested in the problem of modern street lighting.

H. W. Johns-Manville Company, New York, N. Y., gives in its August issue of the *J-M Power Expert* a description of the Audiffren-Singrum refrigerating machine. This machine is put on the market for use in residences, hotels, creameries, steamships, railroads, butcher shops and other places where expert attendance is not at hand, and where it is used in connection with ordinary refrigerators, displacing the disagreeable and cumbersome handling of ice.

General Vehicle Company, Long Island City, N. Y., has sold five 2,000-pound and three 750-pound trucks to the Consolidated Gas Company of New York; two 3.5-ton trucks to the Kingan Packing Company at Richmond, Va.; one to the Aeolian Company; two additional tower wagons to the Milwaukee Railway & Light Company; and four light wagons to the Hartford Electric Light Company. This company is building wagons for nine different department stores.

Crocker Wheeler Company, Ampere, N. J., has issued Bulletin No. 154 dealing with oil-insulated, self-cooling and water-cooled power transformers up to 5,000 kilowatts. These are described in detail and the various parts illustrated. Bulletin No. 153 describes direct-current engine-type generators for lighting and power. This bulletin is also well illustrated and contains tables of resistance and carrying capacity of wires, and ratings, weights and armature bores of the generators.

The Mesta Machine Company, Pittsburgh, Pa., has published a booklet describing and illustrating the plant and some of the products of the company. The plant covers about 20 acres and has about 500,000 square feet of floor space under one roof, and over 400,000 square feet covered by electric traveling cranes. The only limit to the size and weight of machinery it builds is that which the railroads can handle. The principal product of the plant of the Mesta Machine Company is machinery for steel works, blast furnace and power plants.

The National X-Ray Reflector Company, 235 West Jackson Boulevard, Chicago, Ill., has prepared an elaborate and handsome addition to its loose-leaf bulletin. This is in the form of a series of off-set photogravure reproductions of installations employing the "Eye-Comfort" indirect system of illumination. These sheets also contain full descriptive matter explaining the characteristics of the interiors illuminated and the engineering data relating to height of ceiling, type and size of lamp and reflector, and watts per square foot involved.

The Ideal Electric & Manufacturing Company, Mansfield, O., has issued Bulletin No. 1091 dealing with elevator motors for direct and alternating current. The characteristics of the Ideal motors are shown by curves, and much other interesting information is given regarding this equipment. Many illustrations are given of the motors and controlling devices, with detailed descriptions. This company has a separate elevator engineering department in charge of a competent engineer, and is ready to assist manufacturers in selecting the type of motor best suited to any given set of conditions, as well as to design and build special motors where such are needed.

The J. W. Turner Improvement Company, Des Moines, Iowa, is rebuilding the water-power plant of the Des Moines Electric Company. The work consists of coffer-damming, building a head race, of putting in new concrete piers and arches under the building, rebuilding the wheel pits, and installing new screens and gratings. The substructure is also being overhauled and rebuilt. It is expected that the work will be finished about the middle of this month. The company is also building a slack-water dam for the city of Des Moines just off the forks of the Des Moines River. The object of the dam is to raise the water to cover the bars in the river and to back the water up as far as the Des Moines Electric Company's dam.

Harrison Safety Boiler Works, Philadelphia, Pa., is calling attention to the Cochrane "Multiport" exhaust-outlet valve for use with exhaust steam-heating systems, drying systems, condensers, etc. This valve is fitted with a number of small light disks held in position by internal springs. There is little chance that all the disks in a valve will become nonoperative at once. Dash pots, one for each disk, eliminate all noise. The tension on the springs can be adjusted by means of a movable pressure plate operated by a handwheel from the outside, or from a distance by means of electric motor, chains, etc. These valves are arranged for vertical or horizontal flow, and for both back-pressure and vacuum work. Engineering leaflet No. 11 gives further particulars of this device.

General Electric Company, Schenectady, N. Y., has issued an attractively bound book of 132 pages devoted to direct-current railways using voltages up to 2,400. The advantages of the higher voltages in this connection are set forth and numerous tables given comparing the costs of 1,200-volt and 600-volt systems. Station and car equipments and locomotives are described and illustrated, as well as various systems using 1,200, 1,500 and 2,400 volts. Bulletins Nos. 4932 and 4976, dealing with electricity in the brewing industry and in grain elevators and flour mills, have also been recently issued. Another publication which

will be of interest to agriculturists is entitled "Irrigation with Electrically Driven Pumps." This illustrates various installations of this type and contains charts giving comparative crop yields for irrigated and non-irrigated lands. There was also issued Bulletin 4850B dealing with Mazda lamps for standard lighting service. Illustrations are given of the lamps and of typical installations, along with data valuable to those occupied in the design of lighting installations. A table is also given showing the total cost of lighting with Mazda lamps. The lumens obtained per watt with Holophane reflectors under various conditions of ceiling and walls are also tabulated. Distribution curves from the Holophane reflectors and illustrations of General Electric wiring devices are also included.

Record of Electrical Patents.

Issued by the United States Patent Office, August 13, 1912.

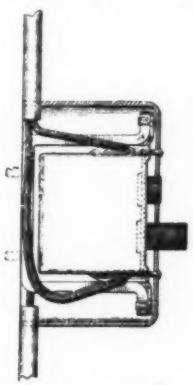
1,035,133. Electrolytic Cell. E. A. Allen, assignor to J. F. Preston, Lowell, Mass. A duplex cell with an intermediate anode and outer cathode compartments.

1,035,149. Incandescent-Electric-Lamp Socket. C. H. Bissell, assignor to Crouse-Hinds Co., Syracuse, N. Y. Includes a U-shaped spring switch.

1,035,157. Telephone System. H. P. Clausen, assignor to Stromberg-Carlson Telephone Manufacturing Co., Rochester, N. Y. Relates to the condensers and repeating coils in the cord circuits.

1,035,158. Telephone Apparatus. H. P. Clausen, assignor to Stromberg-Carlson Telephone Manufacturing Co. In the subscriber's set a condenser is placed in series with both the bell and receiver.

1,035,159. Telephone System. H. P. Clausen, assignor to Stromberg-Carlson



1,035,380.—Wall-Switch Mounting.

Telephone Manufacturing Co. Relates to the line and cut-off relays.

1,035,167. Battery Plate. E. G. Dodge, South Orange, N. J. Consists of compressed copper oxide and a backing of enameled iron to which the oxide is fastened by the enamel.

1,135,172. Telephone System. A. H. Dyson, assignor to Stromberg-Carlson Telephone Manufacturing Co. A trunking system between a centralized call exchange and a common-battery exchange.

1,035,173. Telephone Apparatus. A. H. Dyson, assignor to Stromberg-Carlson Telephone Manufacturing Co. Relates to the lamp-signal relays for the above.

1,035,177. Type-Writing Machine. P. P. Finigan, Washington, D. C., assignor of one-fifth to H. H. Bliss. Is operated by an electric motor.

1,035,178. Electric Battery. C. D. Galloway, Jr., Elizabeth, N. J. A gas vent for a storage cell arranged to prevent leakage of electrolyte.

1,035,204. System for Measuring the Capacity of Electrical Conductors. O. M. Leich and C. E. Hague, assignors to Stromberg-Carlson Telephone Manufacturing Co. A manually operated switch first closes the charging circuit, then automatically opens it and connects the measuring instrument to the cable being measured.

1,035,212. Insulator. L. McCarthy, Boston, Mass. Has an H-shaped longitudinal section, the shell being made of mica.

1,035,215. Electrode. M. McGary, Helmer, Idaho. Consists of a hollow circular casing within which a sponge is placed to moisten the contact with the patient's body.

1,035,227. Electric Connector. L. F. Parkhurst, assignor to Diamond Electric Co., Binghamton, N. Y. For connecting a round and a ribbon conductor in a heater.

1,035,231. Insulator. L. M. Randolph, Newark, N. J. A suspension insulator unit with a flaring porcelain petticoat.

1,035,247. Means for Attaching Binding-Posts to Dry Batteries. W. A. Scott, assignor to New Era Manufacturing Co., Seattle, Wash. A bifurcated post fitting over the edge of the cell and clamping the wire to the deflected edge.

1,035,249. Locomotive Current-Supplying Mechanism. F. L. Sessions, assignor to Jeffrey Manufacturing Co. The bottom of the trolley pole is vertically adjustable.

1,035,257. Instrument for Teaching Telegraphic Codes. T. M. St. John, New York, N. Y. Includes a switch which in one position causes the sounder to act as a buzzer.

1,035,292. Sounder. E. C. Wood, assignor to Submarine Signal Co., Waterville, Me. Includes an electromagnetic vibrator.

1,035,318. Ignition Apparatus for Explosive Engines. D. E. Collard, Jefferson, Colo. The dynamo may be swung horizontally to bring it into engagement with the driving pulley.

1,035,325. Battery Element. E. G. Dodge, South Orange, N. J. A modification of No. 1,035,167.

1,035,326. Process of Making Battery Plates. E. G. Dodge, South Orange, N. J. Copper oxide is compressed on the enameled surface of a metallic backing plate and then the whole is fired to unite the oxide and enamel.

1,035,334. Wireless Telegraphy. R. A. Fessenden, assignor to National Electric Signaling Co., Pittsburgh, Pa. The apparatus for a steel battleship has the lead from the antenna inclosed in a copper sheath.

1,035,338. Lightning Arrester. F. T. Forster, assignor to General Electric Co. An electrolytic-cell arrester with interchangeable end connections.

1,035,354. Signal Transmitter. W. Kaisling, assignor to Kellogg Switchboard & Supply Co., Chicago, Ill. A telephone calling device with special finger holds.

1,035,355. Telephone Support. W. Kaisling, assignor to Kellogg Switchboard & Supply Co. A disk set has the calling device mounted in the base.

1,035,373. Alternating-Current Induction Motor. B. McCullom, Washington, D. C. Thin strips of iron and copper are placed edgewise around the core and short-circuited at the ends.

1,035,378. Electromagnetic Instrument. W. K. Menns, assignor to C. H. Pearson, Brookline, Mass. Includes a rotating magnetic field, a rotor and thermostatic devices.

1,035,380. Support and Housing for Electric-Switch Mounting. S. Morris, assignor to Hart & Hegeman Manufacturing Co., Hartford, Conn. A U-shaped support for the switch is secured to the wall and a cover fits over the whole.

1,035,390. Electromagnetic Carrier for Glass Bodies. P. T. Sievert, Dresden, Germany. A ring-shaped lifting magnet.

1,035,394. Alternating-Current-Distributing System. S. D. Sprong and W. E. McCoy, New York, N. Y., assignors of one-third to F. W. Smith. The primary and secondary of a step-down transformer are connected to the mains through opposed coils of a current transformer, a third coil on which

1,035,415.—Insulator with Spring Clips.

is short-circuited by a fuse in the secondary circuit.

1,035,405. Telegraphic-Tape Perforator. G. A. Arnold, assignor to Telepost Co., New York, N. Y. Punch-operating devices are actuated by the dot and dash keys.

1,035,415. Insulator. R. L. Brown and G. Brown, Mayview, Mo. Has spring clips holding the wire in place of a tie wire.

1,035,443. Combined Coupling and Nipple for Electric Outlet Boxes. O. von Humrick, Detroit, Mich. The removable section forms a tubular sleeve with the main section and is secured to it by pivoted links and a bow.

1,035,489. Apparatus for the Production of Ozone. J. Steynis, Bay Shore, N. Y., assignor to Steynis Ozone Co. Has concentric electrodes with discharge rings on the inner one.

1,035,493. Telephone-Line Selective-Switch Device. J. H. Swanson, assignor of one-half to T. F. Robinson and one-half to Robinson-Loomis Motor Truck Co., Minneapolis, Minn. A relay for connecting and disconnecting

a subscriber's to a central-station line.

1,035,494. Trolley Wheel. W. F. Swoveland, Altoona, Pa., assignor of one-half to W. C. Fletcher. Has a flexible bearing.

1,035,499. Cable-Armor Joint. W. P. Traver and L. F. Theis, San Francisco, Cal. Comprises clamps to be connected to a cable and threaded bars to be connected to the clamps to relieve the cable of all load between the clamps.

1,035,501. Electrical Device for Controlling from a Distance any Number of Movements. P. Viry, Suresnes, France. Each of a number of coils at the reciving station has a vibratory device associated with it.

1,035,535. Clutch Device. J. P. Coleman, assignor to Union Switch & Signal Co. Swissvale, Pa. An electromagnetically controlled friction clutch.

1,035,541. Amalgamator. C. F. Cropsey, Chicago, Ill. Has electrodes at opposite ends of the cylinder.

1,035,555. Electric Heater. E. C. Donaldson, Detroit, Mich. A housing is provided over an incandescent lamp and its socket.

1,035,563. Safety Device for Electric-Current Machinery. J. M. S. Fontecha, assignor to Compania Explotadora de los Inventos Juliá S. A., Mexico, Mexico. A high and a low-current-carrying fuse are provided for each lead of the machine; a switch can short-circuit the heavy fuses.

1,035,568. Telautograph. R. T. Frazier, Jr., Washington, D. C., assignor of one-half to F. Shuman. Associated with both the sending and the receiving stylus are several sets of magnet coils disposed at right angles to each other.

1,035,572. Alarm-Sounding Device. R. A. Gasch, Seattle, Wash. Operation of a safety valve closes an electric alarm circuit.

1,035,577. Telephone Receiver. S. P. Grace, Pittsburgh, Pa. A motor-driven disk moves between the pole pieces of the receiver electromaget.

1,035,593. Motor Starter. C. Jewell, assignor to Jewell Electric Co., Baltimore, Md. Has special short-circuiting devices for the starting resistances.

1,035,594. Window Reflector. G. B. Johnson, Chicago, Ill. Consists of a number of independent but connectable trough sections, each with an incandescent lamp.

1,035,596. Electric Furnace. M. J. Johnson, Naugatuck, Conn. Has a quartz lining inside of an electrical resistance layer.

1,035,624. Lamp Shade. N. B. McGhee, Temple, Ariz., assignor of one-half to A. A. Smith. The shade consists of quadrant wings that are hooked into a collar about the lamp socket.

1,035,633. Apparatus for Cleaning Metal Articles. J. D. Phillips and C. Hambuechen, Madison, Wis., assignors to Ramsay-Vance Sales Co. The cleaning is done electrolytically.

1,035,672. Electrocuting Device for Rats. A. Ziavin, Shelton, Wash. Opposed contact plates are carried on the bait holder.

1,035,684. Method of Producing Compounds of Oxygen and Nitrogen. P. Bunet, Paris, and A. Badin, Salindres, France, assignors of one-third to Compagnie des Produits Chimiques d'Alais & de la Camaigue, Salindres, France. Successive layers of air are supplied to successive electric arcs.

1,035,692. Adapter. T. Deaderick, Nashville, Tenn. For changing a flush plug receptacle into a screw-type attachment plug.

1,035,705. Railway Signaling System. L. F. Howard, assignor to Union Switch & Signal Co., Swissvale, Pa. Is operated by two alternating-current sources.

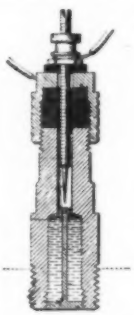
1,035,710. Hot-Bearing Alarm. R. L. Jobson, Kinston, N. C. The expansion of mercury in a chamber closes an alarm circuit.

1,035,717. Dynamo-Electric Machine. J. C. Macfarlane and H. Burge, assignors to Crompton & Co., Ltd., Chelmsford, England. Has a ring armature and separate fields, one for the machine as a motor and the other as a generator.

1,035,723. Method and Apparatus for Producing Chemical Reactions in a Mass of Gases. A. A. Naville, P. A. Guye and C. E. Guye, assignors to Southern Power Co., New York, N. Y. An alternating-current arc plays in a rotary magnetic field.

1,035,743. Gas and Electric Fixture Attachment. J. L. Robb, Amistad, N. Mex. A crowfoot has a bowl with a ball fitting in it. A vertical conductor tube passes through the ball.

1,035,745 and 1,035,746. Alarm or Acoustic Apparatus. E. Rubes, Brooklyn, N. Y. An electric motor operates a resonator.



1,035,710.—Hot-Bearing Alarm.

1,035,784. Clamp for Machine Tools. G. E. Greenleaf, assignor to Niles-Bement-Pond Co., Jersey City, N. J. Has a pair of solenoids.

1,035,804. Air Compressor. M. Mintz, Rock Island, Ill. Is operated by an electric motor with vertical rotor.

1,035,811. Shooting Range for Rifle and Revolver Practice. J. Paterson, London, Eng. Has an electrical indicating and recording device.

Patents that Have Expired.

Following is a list of electrical patents (issued by the United States Patent Office) that expired August 20, 1912.

544,419. Electric - Wire - Containing Hat or Cap Band. Alfred M. Rodriguez, Brooklyn, N. Y.

544,430. Support for Electrical Batteries Used on Vehicles. Thomas Froggat, London, England.

544,436. Automatic Safety Appliance for Electric Conductors. Adelbert E. Hutchins, Detroit, Mich.

544,501. Cleat for Holding Electric Wires. Elisha W. Buffington, Fall River, Mass.

544,502. Support for Incandescent Lights. Charles A. Carmany, Middletown, Pa.

544,514. Electric Gas Lighter. Eric Orling, Stockholm, Sweden.

544,529. Electric Arc Lamp. Richard H. Cunningham, Richmond, Va.

544,530. Apparatus for Insulating Wire. Tobias N. Hallanger, Chicago, Ill.

544,531. Insulated Electric Conductor. Tobias N. Hallanger, Chicago, Ill.

544,545. Signal Apparatus for Telephone Exchanges. Joseph J. O'Connell, Chicago, Ill.

544,546. Apparatus for Telephone Exchanges. Joseph J. O'Connell, Chicago, Ill.

544,552. Electrotherapeutic Appliance. John E. Wiles, Milwaukee, Wis.

544,567. Electrical Signaling Apparatus. William W. Dean, St. Louis, Mo.

544,578. Electric Arc Lamp. John H. J. Haines, New York, N. Y.

544,633. Combination Dynamo. Ernest P. Warner, Chicago, Ill.

544,634. Electric Lighting Attachment for Gas Burners. Frank A. Webb, Beverly, Mass.

544,647. Automatic Electrical Railway Signal. Charles R. Alsop, Middletown, Conn.

544,654. Plant for Generating Electricity. George R. Bowen, San Antonio, Tex.

544,668. Apparatus for Electroplating. Frank Engelhard and Frederick H. Engelhard, Springfield, Mass.

544,673. Secondary Battery. Frank King, London, England.

544,685. Electric Locomotive. Edwin H. Porter, Radford, Va.

544,711. Telephone Switch and System. Ernest C. Wilcox, Meriden, Conn.

544,745. Electrically Controlled Weighing Apparatus. Lorenzo H. Nutting, Davenport, Iowa.

544,747. Manhole for Electric Cable or Other Subways. Ernest I. Ransome, Chicago, Ill.

544,749. Electric Motor. Benjamin P. Remy, Peru, Ind.

544,768. Electric Elevator. Nils O. Lindstrom, Union Course, N. Y.

544,780. Electric Elevator. John C. Winters, Mount Morris, N. Y.

544,781. Electric Switch. Thomas H. Brady, New Britain, Conn.

544,844. Carbon-Brush Holder for Dynamo-Electric Machines. Alexander J. Churchward, Brooklyn, N. Y.

544,847. Apparatus for Insulating Electrical Conductors. Louis W. Downes, Providence, R. I.

544,861. Applying Power at a Distance by Means of Electricity. James F. McLaughlin, Philadelphia, Pa.

544,862. Electric Railway. James F. McLaughlin, Philadelphia, Pa.

544,876. Ship's Telegraphic Apparatus. Johannes K. Adelsberg, Liverpool, England.

544,890. Magneto-Electrical Telephone. Max Frank, Munich, Germany.

544,901. Telephone-Exchange Apparatus. Joseph J. O'Connell, Chicago, Ill.

544,937. Electric Train Signal. Francis C. E. Von Sternberg, Brooklyn, N. Y.

545,005. Multiple Electric Circuit and Mechanism for Maintaining Same. Timothy K. Ames, and Elbert A. Parker, Peterborough, N. H.

545,020. Electrically Controlled Winding Mechanism for Time-Locks. William H. Hollar, Philadelphia, Pa., George L. Weaver, Boston, Mass., and Anthony Kennedy, Charlestown, W. Va.

545,021. Electric Winder for Time-Locks. William H. Hollar, Philadelphia, Pa., George L. Weaver, Boston, Mass., and Anthony Kennedy, Charlestown, W. Va.